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Increasing Access to Science Oriented Education Programmes in Tertiary Institutions in Ghana Through Distance Education

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Abstract

There is emphasis in the educational policy of Ghana for the promotion of Distance Education programmes to widen access to education at all levels and facilitate human resource development. This study examined the level of access and challenges faced by learners in science oriented programmes offered by distance in the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. The study used descriptive statistics for analysing data from 120 learners and 8 facilitators from three science based programmes. The findings indicated that the top-up initiative programmes by distance increased enrolment and participation of learners in 3 science oriented programmes in KNUST. We found evidence of high rates of learners' persistence in the three science programmes which were linked to factors such as strong personal determination to succeed in achieving higher academic status, the availability of learning materials for the courses and support from family members (spouse, children, and friends). The study indicates that both learners and facilitators faced challenges that ranged from lack of time as a result of work activities to delays in receiving course materials among students and short contact hours with learners to low remuneration for facilitators.

Introduction

Tertiary education in Ghana has provided the avenue for the training of technocrats and professionals for the private and public sectors of the economy. It has been the backbone of the various sectors of the economy by providing avenues for the development of the required human capital for development (National Council For Tertiary Education (NCTE) Policy, 1999). However, demand for tertiary education, nationally in the last few decades has outstretched the limited resources of educational institutions. As a result, access has become critical and is available to only a few, especially in the science and technology related disciplines. Access in this study emphasises enrolment, participation and completing a programme. The 2010-2020 Education Strategic Plan (ESP) of the Ministry of Education targets 60% enrolment in science and technology related disciplines for all universities in Ghana (ESP Report, 2012). However, available statistics indicate that during the 2007/08 academic year the enrolment ratio stood at 38% for science and technology related disciplines and 62% for humanities at public universities, and 32% for science and technology and 68% for humanities for public polytechnics (ESP Report, 2010).

The educational policy of Ghana has emphasised the promotion of Distance Education programmes to increase access to education at all levels and facilitate human resource development (NCTE, 2006). Distance education/learning is a method of delivering educational content to the adult learner in institutions of higher education. The structure of distance learning gives adults control over the time, place and pace of education. According to Mitchell *et al.* (2005), distance learning involves a student-centered

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approach in which the instructor takes the role of the facilitator and students engage in peer learning.

Numerous advantages of Distance learning (DL) have been cited by researchers. Bruce (1999) indicated that students with disabilities and those who work full time or serve in the military may find that DL offers more opportunities than traditional education. Specialized classes with low enrolments in a traditional classroom setting can be offered in DL (Olszewski-Kubilius and Lee, 2004). According to Anspaugh (2009), DL can potentially eliminate all biases toward race, age, and physical disability that might occur in the classroom. Malik *et al.* (2005) noted that DL has the potential to impact all levels of education, especially at the tertiary education level, where the maximum benefits in terms of economic impact could be achieved.

Although the advantages of DL are obvious, there are also problems. Kerka (1996) affirmed that Distance Learners need to be responsible, have self-discipline and have a certain amount of motivation to complete their course work. Cereijo (2006) asserted that distance education works best for mature, motivated, well-organized, and already accomplished learners. Moore and Benbasat, (1991) emphasise that the physical separation leads to a psychological and communication gap. Also, Mallory (2007) opines that the opportunity for the student to make a cognitive connection within the course material may be lost because of time delay.

Some studies have highlighted the problem of high attrition rates with distance learning (Kember, 1989; Simonson et al., 2000). Berge and Huang (2004) identified variables linked to attrition, such as a) age, gender, ethnicity, income, previous academic experience, and motivation; b) institutional variables, such as institutional attitude and learner support; and c) circumstantial variables, such as the nature and quality of the interaction between students and institution, course design, and facilitation.

According to Nigam and Joshi (2007), the feasibility of offering non-science courses is an accepted entity but distance education in sciences/science and technology is still grappling with numerous implementation stages. In their study about teaching computer science courses in distance learning, Huan *et al*. (2011) noted that besides the general problems associated with DL, certain challenges arise when teaching computer science courses to students who are not physically co-located and have individual learning schedules. The physical separation of the instructor and students in distance learning creates a significant barrier in teaching students basic skills in using new software or debugging a programme. However, they suggested that better demonstration and interactivity in science-based programmes can be achieved by using flash technologies and animated simulations, and employing synchronous communication technology which works as the collaborative platform allowing the instructor and students to have real time application sharing.

In the light of the mixed reactions to the use of distance learning to provide access to tertiary programmes, especially in science and technology oriented programmes, there is a need to research the issues and challenges faced by distance learners and facilitators pursuing and teaching tertiary degrees in science oriented programmes. Results of such studies can be used to strengthen the application of distance learning in increasing learners' access to science oriented programmes.

The Kwame Nkrumah University of Science and Technology (KNUST) Top-Up Programme

The Kwame Nkrumah University of Science and Technology is one of the four public universities in Ghana offering higher education programmes in dual mode. KNUST Corporate Strategic Plan (Plan 2K14) includes an objective to provide manpower training, research and innovation in science and technology for national development. To meet the university's expectation, the Institute of Distance Learning (IDL) was established in 2005 to deliver programmes of study both on-going and new ones from all colleges of the university in the distance learning mode. The mode of delivery of programmes offered by IDL is predominantly by print medium and is supplemented by the electronic medium (virtual classroom and telephony) and occasional face-to-face tutorials.

Recruitment and registration procedures for distance learners in IDL are the same procedures for the conventional students. The programmes are promoted through radio and newspaper advertisements. Learners' selection for a programme is based on the requirement of the department concerned. On admission, a student is required to register after payment of the appropriate fees which vary from one programme to the other. Programmes are fee paying with no financial support from the university or the government of Ghana. However, some learners obtain financial aid from their work places. Fee levels for science based programmes range from $600 to $800 per semester

depending on whether or not it is laboratory-based. First year learners are required to pay full or 70 percent of fees while continuing students pay full or 50 percent of the appropriate fees per semester.

Learner support services are provided by IDL to motivate learners and facilitate learning to improve cohort completion rate. They include orientation, occasional face-to-face facilitation, provision of course materials, and access to on-campus facilities (e.g., the library and ICT facility). Course assessment of distance learners in KNUST is not different from that of the conventional students. Assignments, quizzes and end-of-semester examinations are continually used to obtain information about student performance. Continuous assessment consists of mid-semester examinations and assignments constituting 30 percent of the total mark for undergraduates and 40 percent for postgraduates. The end-of-semester examination constitutes 70 percent for undergraduates and 60% for postgraduates respectively.

In order to increase access to KNUST programmes by distance, IDL introduced an initiative known as the top-up programme leading to the award of the BSc. degree in various science and technology disciplines. The top-up initiative was designed to help persons with good diplomas and in gainful employment to upgrade and improve themselves academically to enhance their output at work and ultimately to ensure national growth and development. The admission requirement to pursue a top–up programme is the HND or other equivalent diploma with a minimum of a 2nd Class Lower Division. In addition, admission requirements include English, Mathematics, and Integrated Science with a total aggregate not exceeding 24 at the Senior High School Level plus at least two years work experience in the relevant field. The programmes are supported through a number of distance learning centres. These centres provide counseling facilities on pre-determined schedules and also act as information and examination centres.

Six undergraduate science oriented programmes including Electrical and Electronic Engineering, and Building Technology have been offered as top–up programmes since the 2010/11 academic year (IDL records, 2012). The bachelor degree programmes in science have a five semester duration. The first semester is used as a bridging period and the students' entry into the following semester (third year) depends on grades obtained during the bridging. The *2010-2012* enrolment of top-up programmes is summarised in Table 1.

Table 1. Enrolment for Top-up programmes at the IDL, KNUST, 2010-2012

Year	Programme	Student Enrolment		
		Male	*Female*	*Total*
2010-2012	*BSc Telecommunication Engineering*	*73*	*8*	*81*
2010-2012	*BSc Electrical and Electronic Engineering*	*313*	*6*	*319*
2010-2012	*BSc Computer Science*	*42*	*5*	*47*
2011-2012	BSc Construction Technology and Management	202	8	210
2011-2012	BSc Quantity Surveying and Construction Economic	242	12	254
2011-2012	BSc. Mechanical Engineering	253	1	256
2011-2012	BSc. Statistics	57	13	70

2011-2012	BSc. Business Administration	433	160	593

Source: IDL records, 2012

Research Problem

Concern has been expressed about lower enrolment rates for science and technology oriented programmes compared to humanities and business oriented programmes in tertiary institutions in Ghana. According to the National Council for Tertiary Education (NCTE, 1999), enrolments in science/technology and humanities programmes in public tertiary education do not correspond to NCTE standards and norms. For instance, in the 2007/2008 academic year, science students enrolled in public universities and polytechnics were 38% and 32% respectively, as compared to the 60% enrolment target specified for science programmes in universities and polytechnics (Ghana MOESS, 2008). According to the Nuffic report (2009), currently only one-third of applicants for the sciences (science, agriculture and engineering) are accepted for enrolment at the tertiary level. The reason for this is not that they do not meet the minimum requirements set by universities but due to insufficient training facilities (laboratory space, equipment, etc).

The inability to enrol more science students could be partly due to the lack of innovative programmes and modes of delivery needed to serve the diverse needs of the different persons who want to access science oriented tertiary education. While the organisation of remedial programmes for prospective science students in the University of Cape Coast and the implementation of top-up undergraduate programmes by distance in KNUST has increased students access to science oriented programmes in Ghana, many challenges still remain. According to Nigam and Joshi (2007), the development of programmes in science and technology areas is a complex and dynamic process with many typical problems, since they need more interaction and the cooperation of teachers, learners and institutions.

The study examined the level of access and challenges faced by learners in science top-up programmes offered by distance in KNUST. Specifically, the study sought to investigate:

  i. the level of access to BSc Telecommunication Engineering, BSc Electrical and Electronics Engineering and BSc Computer Science programmes by distance mode
  ii. the level of completion and attrition in the three programmes, and
  iii. the challenges faced by students and facilitators of the three programmes.

Methodology

The descriptive survey research design was adopted for the study. This method was appropriate as it involved the collection of extensive and cross-sectional data for the purpose of describing and interpreting an existing situation under study. The survey population was drawn from the 2010 and 2011cohort of learners and facilitators from three science oriented top-up programmes in KNUST. These were BSc. Electrical and Electronic Engineering, BSc. Telecommunication Engineering and BSc. Computer Science. The learner population comprised 447 students and the total number of facilitators was 12. Proportional quota sampling was used to select 120 respondent with quotas based on the enrolment in the three science based programmes. Eight facilitators from the three programmes, who were considered knowledgeable of the issues under study were purposively selected for in-depth interviews.

Data were collected with the use of a questionnaire, interview schedule and review of IDL documents. The study therefore involved the use of multiple sources of information (triangulation) to provide exhaustive information on the topic under study. A questionnaire comprising closed and open-ended questions was developed and administered to the final year learners to solicit data on challenges they face as distance learners. Departmental documents such as IDL students' database were analysed to gather information on learner enrolment, attrition, gender and age. According to Merriam (1998), data found in documents can be used in the same manner as data from interviews or observations. The researchers used face-to-face and telephone interviews to elicit information from course facilitators and distance learners respectively. Structured interview guides were used based on two major criteria, namely challenges faced by learners and facilitators and attrition (drop-out)/persistence in the programmes.

Data were analysed using descriptive statistics such as frequency counts and percentages. This was done with the aid of MS Excel software.

Results and Discussions

Level of Access to Science Programmes

Document analysis indicated that two cohorts of students totaling 447 had enrolled in the three programmes in 2010 (228) and 2011 (219) respectively (Table 2 below). Electrical and Electronic Engineering was the most heavily enrolled of the programmes (71%) followed by Telecommunication Engineering (18%). Computer science was the least accessed programme (11%) in the two cohorts. The table shows that males constituted the majority of the students (95 %) who enrolled and participated in the three top-up science oriented programmes in 2010 and 2011. This indicates a low enrolment of females (4%) which implies a total male dominance of the programmes. The result is in consonance with the findings of researchers such as Przymus (2004) and Plummer (2000) who observed that women in distance learning are under-represented in science, technology, technical and mathematics oriented courses.

Table 2. Enrolment in three science oriented programmes by learner cohorts and gender

Programme	Cohort 1 (2010/11)			Cohort 2 (2011/12)		
	Male	*Female*	*Total*	*Male*	*Female*	*Total*
BSc. Telecommunication Engineering	42	8	50	32	0	32 (18%)
BSc. Electrical and Electronic Engineering	150	1	151	160	7	167 (71%)
BSc Computer Science	23	4	27	19	1	20 (11%)
Total	215 (94%)	13 (6%)	228 (100%)	211 (96%)	8 (4%)	219 (100%)

Source: IDL records, 2012

Table 3 belowshows an analysis of learners' record on attrition (drop-out) of the 2009/10 cohort. A total of 228 students out of 235 enrolled in the bridging courses in the 3 programmes during the 2009/10 academic year proceeded to level 300 (3rd year) in 2010/11 academic year. This shows an attrition rate of about 3% for the 2009/10 bridging cohort. Two hundred and twenty four out of the 228 students in level 300 proceeded and participated in the three programmes in the 2011/12 academic year showing an attrition rate of about 5 percent. The few learners who dropped out before the completion of the programmes did so because of poor academic performance (i.e. they obtained less than 40% of the weighted average marks) as they moved from one academic year to the next.

Attrition in the Programmes

Table 3. Student Attrition in 2009/10 Cohort

Programme	2009/10 (Bridging)	2010/11 (3rd year)		2011/12 (4th year)			
	No. enrolled	No. registered	Attrition rate (%)	No. registered	Attrition rate (%)	No. graduated	
BSc.	50	50	0	48	4	45	

Telecommunication						
BSc. Electrical and Electronic Engineering	158	151	4.4	149	1.3	54
BSc Computer Science	27	27	0	27	0	23
Total	235	228	2.97	224	5.3	122

Fifty five percent of the registered learners graduated at the end of the fourth year. The BSc. Electrical and Electronic Engineering programme comparatively had the least percentage (36%) of learners who graduated; the 45% of the learners who could not graduate are trailing in one or more courses and are still registered with the programmes.

Brindley (2001) indicated that some distance education/open learning courses sometimes have higher rates of retention than contact courses. However these findings are not consistent with the results of some studies that have highlighted the problem of high attrition rates with distance learning (Kember, 1989; Simonson et al., 2000; Adewale and Inegbedion 2008).

Interviews with persisting students have revealed several reasons for their continuation of the programmes despite some challenges. The main reasons are depicted in Table 4 below. The findings in Table 4 indicate that majority of students (80.6%) attributed their persistence (retention) in the programmes to strong personal determination to succeed in achieving higher academic status. Parker (2003) found, in her study that the level of self-motivation is positively correlated with academic persistence of distance learners. Other strong predictors that help enhance learners' persistence were payment (commitment) of fees, the availability of learning materials for the courses and support from family members (spouse, children, and friends). According to Ojokheta (2010), learners' perception of the course materials is an important predictor for predicting persistence and success of distance learners in distance learning programme.

Table 4. Major reasons for students' continuation of programmes

*Reasons for Persistence	Frequency	%
Determination (Urge) to succeed	97	80.6
The fee paying nature (money commitment) of the program	77	64.3
Availability of learning materials for the courses	45	37.9
Support from family members(spouse, children, friends)	43	35.5
Provision of face-to-face schedule	38	31.5
Scheduling of programs facilitates coping with courses involved	28	23.4
Provision of student support system	19	16.1

Facilitators' Views on Student's Persistence (Low Attrition)

Interviews with facilitators revealed they perceived the very low attrition rate among

distance learners in the three science programmes as the results of stability in the academic calendar of KNUST, and satisfactory academic learner support services (biweekly face-to-face facilitation, timely release of academic results). However, majority of the Electrical Engineering distance learners were unable to graduate at the end of the fourth year due to difficulty in completing their project on time. It has been noted (Okyere, 2012) that BSc. Electrical and Electronic Engineering students could not complete their project on time as a result of workplace activities.

Challenges Faced by Distance Learners and Facilitators

Challenges Faced by Learners

Learners were asked in the survey what challenges they faced in their programmes. Table 5 below provides a statistic breakdown of their responses. The findings revealed that the major challenges (70%) faced by students in the science programmes were: Lack of time due to work (30%), poor cooperation between facilitators and students (21.1%), poor communication between students and IDL (14.4%) and delays in getting course materials to students (4.4%).

Table 5. Challenges faced by distance learners

*Challenges	Freq	Percent
Situational Barriers		
Lack of time due to work	36	30.0
Travelling problems	11	8.9
Payment of fees	1	1.1
Family responsibilities	1	1.1
Institutional Barriers		
Poor cooperative between facilitators and students	25	21.1
Poor communication between students and IDL	17	4.4
Support services difficult to access	9	7.8
Delay in getting course materials	5	4.4
Course materials not user friendly	4	3.3
Practical work not enough	4	3.3
Course content outmoded	3	2.2
Delay for re-sit exams	1	1.1
Access to supplementary reading materials on internet difficult	1	1.1

Source: Field data, 2012

*multiple responses

The challenges identified could be described as both situational and institutional barriers to distance learning. Cross (1979) defined situational barriers as those barriers, which relate to a person's life context at a particular time, including issues revolving around cost and lack of time, and geographic isolation while institutional barriers are those erected by learning institutions that exclude or discourage certain groups of learners because of such things as inconvenient schedules, full-time fees for part-time students, restrictive locations and the like.

Challenges Faced by Facilitators

Five major challenges to participation in distance education emerged from the interviews with the facilitators who were all full-time lecturers of the university. They were; the quality of students, short face-to-face contact period with students, little use of technology for teaching and learning and late distribution of learner materials and low remuneration for facilitation. These challenges can be grouped under access, faculty compensation and time and student support services. According to Muilenburg and Berge

(2001) barriers to distance education can be clustered or grouped under technical expertise, administrative structure, access, faculty compensation and time, and legal issues among others.

Conclusion and Recommendations

This study indicates that that the top-up initiative programmes by distance increased enrolment and participation of learners in the 3 science oriented programmes thereby increasing access to the programmes in KNUST. Males constituted the majority of the students who enrolled and participated in the 3 top-up science oriented programmes by the distance mode. The study provided evidence of high rates of students' persistence in the three science programmes before graduation which were linked to factors such as strong personal determination to succeed in achieving higher academic status, payment of fees, the availability of learning materials for the courses and support from friends and family members (spouse and children). The findings also reveal that BSc. Electrical Engineering had the least percentage of students who graduated as compared to the other programmes.

It was also revealed in the findings that both learners and facilitators faced challenges despite the high persistent rate among students. The challenges ranged from lack of time as a result of work activities to delays in receiving course materials among students and short contact hours to low remuneration for facilitators.
On the basis of the findings, it is recommended that:

1. Programme duration should be extended from the current five semesters to seven semesters to enable learners to have more contact hours to improve performance. However, cost issues should be considered.
2. Learner support services be improved. For instance, the delivery of course materials should be done on time and communication between learners and facilitators enhanced.
3. Other challenges, such as low use of technology, poor remuneration of facilitators and lack of grants for distance learners should be addressed.

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