QUALITY MATERIALS SCIENCE EDUCATION FOR SUSTAINABLE DEVELOPMENT THROUGH DISTANCE LEARNING: THE CASE FOR ZIMBABWE AND NIGERIA

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Abstract

Zimbabwe is rich in human capital and natural resources, and is poised to achieve sustainable growth and development mainly through human capital development. This paper explores the use of open and distance learning (ODL) in materials science education. The main objectives of the research are to:

- identify and assess the main regulatory frameworks that apply to distance and online education in Nigeria and Zimbabwe
- ascertain the feasibility of offering materials science education programmes through open and distance learning (ODL)

The methodology involved mainly a qualitative case study focusing on Nigeria and Zimbabwe. The two countries were purposively sampled to represent two distinct types of policy and regulatory environments. Data collection comprised literature and document review, administration of questionnaires, and field visits to conduct interviews with relevant ministries, regulatory agencies and selected universities. Data collection instruments used were questionnaires and interview schedules.

In 2009, Nigeria had a population of about 154 729 000, with 51.7% being situated in rural areas and 48.3% in urban areas. The population density was 167.5 people per square kilometre. The National Universities Commission (NUC) regulates a total of 117 universities countrywide and provides accreditation at institutional, programme and course levels. Quality assurance is monitored to promote standards and ensure that minimum academic standards are met. The National Open University of Nigeria (NOUN) is currently the only uni-mode university mandated for open and distance learning (ODL) in the delivery of university education. There are about six universities which may be regarded as dual-mode universities with limited capacity to deliver degree programmes by the ODL mode in addition to the conventional face-to-face mode. NUC has one of the best regulatory frameworks in the world for promoting quality ODL programmes. The lessons learnt from Nigeria can be adapted and applied to Zimbabwe

and the Zimbabwe Open University (ZOU) in the offering of degree programmes for materials science and courses in nanotechnology, through ODL and e-learning.

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1. Introduction

Both sustainable development and economic growth require innovation. Science, technology and innovation (STI) efforts are usually measured by specific indicators which normally include science enrolment rates in secondary, technical, vocational and tertiary institutions; national spending on science and technology education; research and development spending; research output of institutions; etc. Materials science, an element of STI, is defined as the study of the properties of solid materials and how those properties are determined by a material's composition and structure (Valley City State University 2006). The materials could be metals, ceramics, clothes, semiconductors, etc. Nanotechnology is a new branch of materials science.

This paper explores the use of open and distance learning (ODL) in materials science education. **Distance education** is an approach for delivery or a methodology whereby the learner is separated from the instructional base or teacher, either in space or time, for a significant portion of his or her learning. Distance education is defined by the American Council of Regional Accrediting Commissions (CRAC 2001) as a formal educational process whereby the majority of instruction occurs when student and instructor are not in the same place. In this paper, the term **"open and distance learning (ODL)"** refers to a philosophy of learning that uses an array of educational methods. It is based on the principle of flexibility to increase access to and equity in openness, with a specific role to achieve a development function, social justice/access, and a social mandate aimed at developing human capital.

Zimbabwe is rich in human capital and natural resources, and is poised to achieve sustainable growth and development. A necessary condition for sustainable development is human capital development, which is central to capacity development. **Human capital** is about "the knowledge, skills and competences and other attributes embodied in individuals that are relevant to economic activity" (OECD 1998). Human capital is an asset and a factor of production that can be measured at individual, corporate and national levels. Knowledge-driven sustainable development requires relevant and efficient knowledge. Knowledge is at the centre of sustainable growth and development in many ways, and has become the new currency in the modern age and in spearheading Zimbabwe to become a knowledge-based economy. The modern workforce is now required to possess and adequately demonstrate its ability to adjust to and attain investigative skills, think critically, work independently with others, and apply

knowledge and skills to different situations, while being exposed to constant change. The four pillars of a knowledge economy and sustainable development are as follows:

- **Human capital:** an educated and skilled population to create, share and use knowledge well
- **ICTs:** a dynamic information infrastructure to facilitate the effective communication, dissemination and processing of information
- **Institutions:** an efficient innovation system comprising academia, firms, consultants, SMEs, etc.
- **An enabling policy and legal framework:** an enabling environment with supportive economic and institutional mechanisms

The core materials science education curriculum covers topics such as Introduction to Materials; Experimental Techniques; Thermodynamics; Transport Properties; Phase Equilibria; Phase Transformation; Kinetics; Structure; Characterization; Mechanical Behavior; Electronic, Magnetic, and Optical Behavior; Synthesis, Processing, and Manufacturing; Materials Selection and Design; and Failure Analysis. Materials science education in most African universities is taught through the conventional mode, as is the case in other engineering-related fields. In Canada, Athabasca University continues to develop and thrive in e-learning. Most Australian universities developed substantial capability in distance learning in the 1980s and several have now migrated this to e-learning, including the best-known university, the University of Southern Queensland (Bacsich 2004). In Africa, the African Virtual University is the main player, and has operations in several African countries with instruction in both English and French. The University of South Africa (Unisa) has an active online campus, which offers programmes in the engineering and science disciplines. Another ODL player is the Zimbabwe Open University (http://www.zou.ac.zw.zouonline). The emergence and convergence of information and communication technologies (ICTs) have remained at the centre of global socioeconomic transformation. If implemented properly and carefully, these technologies could reduce or eliminate the imbalance between rich and poor, and the powerful and marginalised.

2. Literature review

2.1 ODeL and blended learning in materials science

The African Virtual University (AVU) stands among other tertiary education networks in Africa at the forefront of efforts to harness the full potential of ICTs for education on the continent. As an educational network, the AVU uses ICTs to provide, in collaboration with partner universities across the continent, quality education to a wide array of learners, including traditional students, lifelong learners and active workers and professionals. The AVU has more than 50 academic partner institutions in more than 27 countries in Africa. The AVU envisions an African higher education platform in which open, distance and e-learning (ODeL) will play an increasingly significant role. In Zimbabwe, the University of Zimbabwe hosts the ODeL Centre for AVU. The purpose of ODeL centres is to act as physical hubs for the creation, organisation and sharing of

knowledge as well as the development, delivery and management of ODeL programmes at AVU partner institutions (http://www.avu.org/AVU-Multinational-Support-Project/odel-centers.html).

In "hybrid" classes, a significant amount of the course learning activity has been moved online, making it possible to reduce the amount of time spent in the classroom.

Traditional face-to-face instruction is reduced but not eliminated. The hybrid course model is also referred to as "blended". According to the University of Wisconsin, Milwaukee (http://www4.uwm.edu/ltc/hybrid/faculty_resources/advantages.cfm), the main advantages of hybrid learning include the following:

- **New teaching opportunities:** The faculty can teach using a variety of online and in-class teaching strategies, which make it possible to achieve course goals and objectives more effectively.
- **Student engagement:** Instructors claim to be more connected with their students and are able to get to know them better as they communicate both online and face-to-face, through increased and extended instructor-student and student-student connectivity.
- **Increased student learning:** Students learn more in the hybrid format than they do in traditional class sessions, write better papers, perform better in examinations, produce higher-quality projects, and are capable of more meaningful discussions on course material when reflecting online.
- **New pedagogical approaches:** Learning to teach a successful hybrid course leads to engaging in more participatory and student-centred learning activities, as the teacher-student relationship is transformed to be more centred on student learning.
- **Documenting the process as well as the product of learning:** The course management system increases pedagogic efficiency because of its ability to organise the course and automate some basic activities such as quizzes, grading and surveys.

2.2 Quality assurance in higher education

There is an increase in public accountability for higher education which compels institutions to demonstrate quality within the programmes and processes, including those provided online. Access to quality education empowers learners to transform themselves and their social, environmental and economic reality toward greater sustainability. In its second decade of involvement in education, the Education Division of the African Union defined a quality management goal of the African Union as being **"to build and implement a sound quality management system in Africa" (**http://au.int/en/dp/hrst/node). Besides the link between quality of education and economic performance, the growing concern around quality has been triggered mainly by cultural relevance, the impact on the population, poverty and HIV/AIDS, the contribution to the development process in rural areas, lifelong learning and achievement of MDG goals. Numerous comparisons have been conducted for a long period of time on the learners' achievements in both distance and face-to-face

conventional situations (Russell 1996). The key findings from the comparison of identical content and hours of instruction show that there is no significant difference between the different types of courses on the learners' achievement as measured by, for example, grades, test scores or performance in the workplace (Verduin & Clark 1991). The conclusions from these studies are, according to Verduin and Clark (1991), and Moore and Kearsley (1996), that:

a) a lack of direct face-to-face contact does not necessarily affect the quality of the learning process
b) there is no evidence that face-to-face instruction is the best method of giving instruction
c) learning at a distance can be as effective as learning in a face-to-face environment
d) learning in any situation is successful when:

- the course is well designed and delivered
- the content, methods and technologies are appropriate for the learning task
- there is learner-to-learner interaction
- there is timely instructor-to-student interaction and feedback

Unisa's vision and mission statements set out its aims for providing a high-quality student learning experience. The learning and teaching strategy sets out the objectives for the development and enhancement of the curriculum and the student learning experience. The University's Quality Assurance Framework supports these aims and objectives by specifying responsibilities and the procedures by which the standards of the academic programme and the quality of the student learning experience are managed, assured and enhanced. There has been some paradigm shift in the concept of higher education due to the changing environment (Pond 2002). Owlia and Aspinwall (1996) studied quality frameworks in other disciplines, such as software engineering, which they argued are akin to higher education, and produced a conceptual framework that groups 30 attributes into the six dimensions of tangibles, competence, attitude, content, delivery and reliability, as shown in Table 1 (Usoro & Abid 2007).

Table 1: Quality dimensions in higher education (with slight adaptation from Owlia & Aspinwall 1996)

No.	Dimensions	Characteristics
1	Tangibles	Sufficient equipment/facilities Modern equipment/facilities Ease of access Visually appealing environment Support services (accommodation, sports, etc.)
2	Competence	Sufficient (academic) staff Theoretical knowledge, qualifications Practical knowledge Up to date

		Teaching expertise, communication
3	Attitude (learner support)	Understanding students' needs Willingness to help Availability for guidance and advice Giving personal attention Emotion, courtesy
4	Content	Relevance of curriculum to the future jobs of students Effectiveness Containing primary knowledge/skills Completeness, use of computers Communication skills and teamwork Flexibility of knowledge, being cross-disciplinary
5	Delivery	Effective presentation Sequencing, timeliness Consistency Fairness of examinations Feedback from students Encouraging students
6	Reliability	Trustworthiness

Research done by Owlia and Aspinwall (1996) appears to be the most comprehensive dimensioning study of the quality of higher education. It appears as if other studies confirm and complement all or some quality dimensions of Owlia and Aspinwall's research. Their study also recognises that quality is in the eye of the beholder. Like Owlia and Aspinwall, the standards of the International Organization for Standardization (ISO) accept that there are a number of stakeholders whose views have to be countenanced to have a holistic measure of quality. The ISO (2007) has defined its higher education (HE) quality criteria as follows:

- content and pedagogical method
- achievements and impact of the programme demonstrated by performance indicators
- connection of the programme to business, governmental and other stakeholder groups
- replicability of the programme, i.e. whether it could be implemented elsewhere in the world
- visibility of the programme, in particular in the media

Lagrosen and Seyyed-Hashemi (2004) form another group of researchers who investigated quality from the students' perspective. The research places great emphasis on increasing the quality of the student support system, as shown in Table 2 below:

Table 2: Approximate mapping of various HE quality frameworks (with slight adaptation from Usoro & Abid 2007)

No.	Owlia and Aspinwall (1996)	International Organization for Standardization (2007)	Hill and Lomas (2003)	Lagrosen and Seyyed-Hashemi (2004)
1	Tangibles		Resources of library and IT	Computer facilities
2	Compe-tence	Profile of teachers	Quality of lecturer	
3	Attitude	Follow-up of students	Student support Social and emotional support systems	Information and responsiveness Collaboration and comparison
4	Content	Content and pedagogical method		Courses offered
5	Delivery	Assessment and follow-up of students		Collaboration and comparison
6	Reliability			
7		Globalisation in terms of number of nationalities of students and replicability of programme		

Shelton (2011) conducted a review of paradigms for evaluating the quality of online education programmes and identified the following common quality indicators of distance education (http://www.westga.edu/~distance/ojdla/spring141/shelton141.html):

- teaching and learning effectiveness
- student/learner support
- technology
- course development/instructional design
- faculty support
- evaluation and assessment
- organisational/institutional impact

2.3 Standards and regulatory frameworks

Competencies or other desired programme outcomes achieved by residency are not relevant to distance education. There is no systematic taxonomy that identifies the technology platforms and the associated pedagogical approaches employed. Experience with the Zimbabwe Open University (ZOU) shows that the key elements of the Quality Assurance Framework include the following:

1. external reference points with the regulatory authority
2. programme regulations and academic policies
3. examination boards and external examiners
4. senate programme approval processes
5. programme and module review processes
6. collaborative programmes with associates, affiliates and other partners
7. student involvement in quality assurance and learner support
8. enhancement of the Quality Assurance Framework to ensure fitness for purpose and fitness of purpose

Accreditation refers to the process whereby an authoritative body evaluates the quality of a higher education institution or a specific educational programme in order to formally recognise it as having met certain predetermined minimal criteria or standards. There is no agreed-upon international usage of key terms in **quality assurance**. UNESCO defines quality assurance as the systematic review of educational programmes to ensure that acceptable standards of education, scholarship and infrastructure are being maintained.[1]

3. Methodology

The methodology involved mainly a qualitative case study focusing on Nigeria and Zimbabwe. The two countries were purposively sampled to represent two distinct types of policy and regulatory environments due to the huge difference between the population size of the countries and the higher education systems in different regions of Africa (West and Southern Africa).

Data collection comprised literature and document review, administration of questionnaires, and field visits to conduct interviews with relevant ministries, regulatory

[1] UNESCO. (2005). Quality Assurance. Retrieved 8 January 2007 from UNESCO website: http://portal.unesco.org/education/en/ev.php-RL_ID=41040&URL_DO=DO_TOPIC&URL_SECTION=201.html

agencies and selected universities. Data collection instruments used were questionnaires and interview schedules. Three main questionnaires were administered and their purpose and structure is summarised below.

Questionnaire	Purpose and structure
Questionnaire type A	This questionnaire was filled in by chief executives of national regulatory frameworks and executive heads of ministries of education, or their designated representatives.
Questionnaire type B	This questionnaire was filled in by the vice-chancellors, deputy vice-chancellors (academic), heads of quality assurance directorates/units and selected staff of ODL institutions.
Questionnaire type C	This questionnaire was filled in by five alumni and existing students of ODL institutions.

Interviews were conducted with key personnel and students at the National Open University of Nigeria (NOUN), the Nigerian National Universities Commission's executive management, and personnel at the Zimbabwe Open University (ZOU) and Zimbabwe Council for Higher Education (ZIMCHE) during the months August and September 2011.

The infodensity of Zimbabwe in the context of Southern Africa was assessed quantitatively to explore opportunities in support of ODL and for sustainable development through effective utilisation of ICTs. Data on infodensity was obtained in 2911 from the International Telecommunications Union (ITU). The 18 countries used in benchmarking Zimbabwe are South Africa, Angola, Botswana, Burundi, the Democratic Republic of Congo, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Rwanda, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe.

4. Data analysis and key findings

The section below presents the key findings from the interviews, questionnaires and literature review.

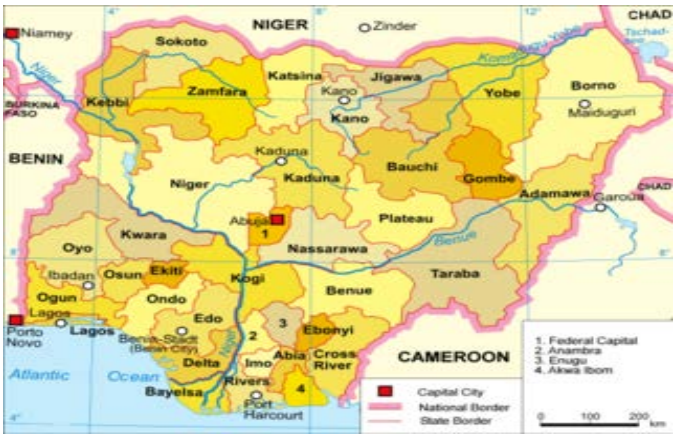
4.1 Introduction

Nigeria, officially the **Federal Republic of Nigeria**, is a federal constitutional republic comprising 36 states and its federal capital territory, Abuja. Nigeria is the most populated country in Africa. The United Nations estimates that the population in 2009 was at 154 729 000, distributed as 51.7% rural and 48.3% urban, and with a population density of 167.5 people per square kilometre. About 20 million people live in Lagos. A map of Nigeria is shown in Figure 2 below.

The education system consists of six years of primary school, three years of junior secondary school, three years of senior secondary school, and four years of university education leading to a bachelor's degree. The National Universities Commission (NUC) is a parastatal under the Federal Ministry of Education (FME) which regulates a total of

117 universities countrywide. The vision of the National Universities Commission is "to be a dynamic regulatory agency acting as a catalyst for positive change and innovation for the delivery of quality university education in Nigeria". The National Open University of Nigeria (NOUN) is Nigeria's leading – and only specialist – provider of open and distance learning at tertiary level. NOUN is also the country's largest tertiary institution in terms of student numbers. It operates from its administrative headquarters in Lagos and has 37 study centres across the country. Student enrolment currently stands above 32 400 and NOUN currently offers over 50 programmes and 750 courses, staircasing through from certificate to diploma and degree level, and maintaining a strong commitment to internationalisation. Educating the workforce of today, and tomorrow, is a key focus.

Figure 2: The 36 states of Nigeria and then Abuja, the federal capital territory



4.2 National Open University of Nigeria's (NOUN) senior management

Questionnaire B was filled in by the vice-chancellors and deputy vice-chancellors (academic), and interviews were conducted with senior management. The key findings are as follows:

- Nigeria as a country has a national regulatory authority or agency for quality assurance and accreditation of higher education and training, which includes ODL and e-learning. Based on the knowledge and practical experiences/interactions with the national regulatory authority or agency for quality assurance and accreditation in the country, the National Universities Commission (NUC) oversees all the universities in the country, with the National Open University of Nigeria (NOUN) being one of them. NUC ensures that quality programmes and staff are maintained. The body embarks on site visitation and supervision, among others, to ensure effective and efficient curricula nationwide.

- The tools used by NUC include the eligibility of programmes, scope of ODL activities (academic), disciplines to be taught, entry requirements, students' delivery modes and staffing issues. NOUN is not aware of how the tools/instruments were developed, certified and adopted for use (i.e. the process), and who were involved

(i.e. people, institutions or organisations). NOUN is required to have the following types of accreditation:

☑ institutional accreditation
☑ programme accreditation
☑ course accreditation

- There are no major challenges that the national regulatory framework and policies (including tools, instruments and processes) pose to the development and promotion of ODL and e-learning at national, institutional and individual levels. Indeed, there are key challenges which developments in ODL and e-learning pose to national regulatory authorities and frameworks in the country specifically and in Africa generally.

- There have been, and still are, moves toward establishing, developing and promoting regional and continental quality assurance and accreditation frameworks for ODL and e-learning. This will ensure quality collaboration among ODL institutions. The greatest impact of the national regulatory framework for ODL and e-learning on access, skills development, employability, mobility of graduates and sustainable development is on quality assurance.

4.3 National Open University of Nigeria's (NOUN) students and alumni

The key responses from the five NOUN students and alumni are as follows:

- NOUN students and alumni enrolled with NOUN to improve themselves academically and to progress on their career path. All the respondents were aware that Nigeria has a national regulatory authority or agency for quality assurance and accreditation of open and distance learning (ODL), including e-learning. All respondents indicated that indeed NOUN has put in place strategies or mechanisms that encourage or ensure that key stakeholders in the institution can access, read and/or engage with the documents used. There is no complaint or reservation about the appropriateness of the policies, procedures and practices that the national regulatory authority or agency for quality assurance and accreditation employs and carries out, with respect to ODL.

- The students and alumni have not felt discriminated against in any regard, by virtue of the fact that they are graduates of an ODL institution or programme instead of graduates of a residential face-to-face institution. Not all the respondents were aware of any other national policies for higher education and training in the country that were discriminative or unfriendly toward ODL students or graduates. The students and alumni of NOUN recommended a way forward in addressing ODL challenges.

- The students and alumni support the establishment of continental frameworks (including standards, tools and instruments) for quality assurance and accreditation for ODL and e-learning. The reasons include the need to improve the general quality of education in Africa to enable them to compete with their counterparts elsewhere in the world; to establish continental assurance accreditation and frameworks for the promotion and development of African ODL programmes; and to ensure that each country on the continent will be able to recognise the respective qualification and its authority. It is envisaged that this will further increase the knowledge and skills of the students continentally and enhance students' mobility globally.

4.4 National Universities Commission's (NUC) executive management

- NUC, as the national regulatory body, provides accreditation for 117 universities at institutional, programme and course levels. This is the same for open and distance learning (ODL), including e-learning. The official instruments/documents that the national regulatory framework for quality assurance and accreditation of open and distance learning and e-learning uses include the instruments for Accreditation (1 conventional and 2 ODL) and self-study by universities, a manual of accreditation procedures with all instruments and a programme evaluation form, and academic centre requirements. Accreditation standards are set with minimum standards required for each institution. Quality assurance is viewed as a way to promote standards and to ensure safety with minimum academic standards.

- According to Ramon-Yusuf (2011), the Nigerian National Policy on Education has over the years recognised the place of open and distance learning in achieving lifelong education and affirms that lifelong education shall be the basis of the nation's education policy. Ramon-Yusuf (2011) further contends that the goals of open and distance education are to:

    - provide access to quality education and equity in educational opportunities for those who otherwise would have been denied this
    - meet the special needs of employers by mounting special certificate courses for their employees at their workplace
    - encourage internationalisation especially of tertiary education curricula
    - ameliorate the effects of internal and external brain drain in tertiary institutions by utilising experts as teachers regardless of their locations or places of work

- However, a critical appraisal of the scope of ODL at any level of education in Nigeria reveals a glaring mismatch between policy and practice. The reality in the Nigerian university system is that there is a need to distinguish between open learning and distance education. True openness especially in terms of entry requirements is to be considered a longer-term objective against the backdrop of the reality in the nation's university education scenario which is characterised by perennial mismatch between the demand and supply sides of the access equation. The current situation is that there are thousands of young qualified candidates seeking university admission who cannot be absorbed into the nation's universities. The National Open University of

Nigeria (NOUN) is currently the only uni-mode university mandated for open and distance learning in the delivery of university education. There are about six universities which may be regarded as dual-mode universities with limited capacity to deliver degree programmes by the open and distance learning (ODL) mode in addition to the conventional face-to-face mode. All stakeholders agree that the practice of distance learning by these dual-mode universities is far below acceptable best practice and that, at best, they are in transition from the running of part-time/sandwich courses to distance learning.

- In order to bring the practice of distance learning up to speed with global practice, it is incumbent on the NUC, as the statutory quality assurance agency in the Nigerian university system, to streamline the practice of distance learning by stipulating a code of good practice. Such a document should clearly enunciate performance standards pertaining to the entire gamut of teaching and learning by the ODL mode, including learner support, which is a critical success factor in open and distance learning. Cognisant of the need to contextualise the applicability of the various ODL delivery modalities, the ODL mode shall not be applicable to academic disciplines in a university that does not have the capability for those disciplines. In view of the nation's present technological and infrastructural challenges, the academic disciplines which may be offered by the ODL mode within the short to medium term (2009−2015) are in fields such as education; administration/management sciences; social sciences; arts/humanities; and sciences and applied sciences.

- All entrants to degree programmes offered by ODL must meet the minimum national requirements for university registration. For all academic programmes to be taught by ODL, interactive texts shall be at the heart of teaching and learning. These shall be supplemented with other resources such as CD-ROMs, DVDs or USB sticks to deliver e-books, simulations, assessment, etc. ODL means that students should not be required to attend classes or have face-to-face contact, unless there are compelling reasons to justify this, such as examinations, periodic facilitation and practicals. ODL programmes shall be predicated on a pedagogy that is led by resources and not reliant on face-to-face intervention. Students should be able to register to study anywhere in Nigeria or any part of the world with a common standard of service at any study centre. The study centre should offer both academic and social support. Study centres should act as the focal points of learning communities and have agreed-upon standards of accommodation in facilities and equipment. Students should be expected to be able to have access to ICT to assist their learning. For specific programmes, functional internet access would be required for all study centres. Assessment will include continuous assessment (a minimum of one marked assignment for every 40 hours of study) as well as summative assessment, e.g. exams and portfolios that provide for validation of achievement. It is expected that assessment tasks will occupy a minimum of 10% of study time. The course score should depend on both the continuous and final assessment. The workload on staff may be reduced by the use of automatically marked ICT-based assignments.

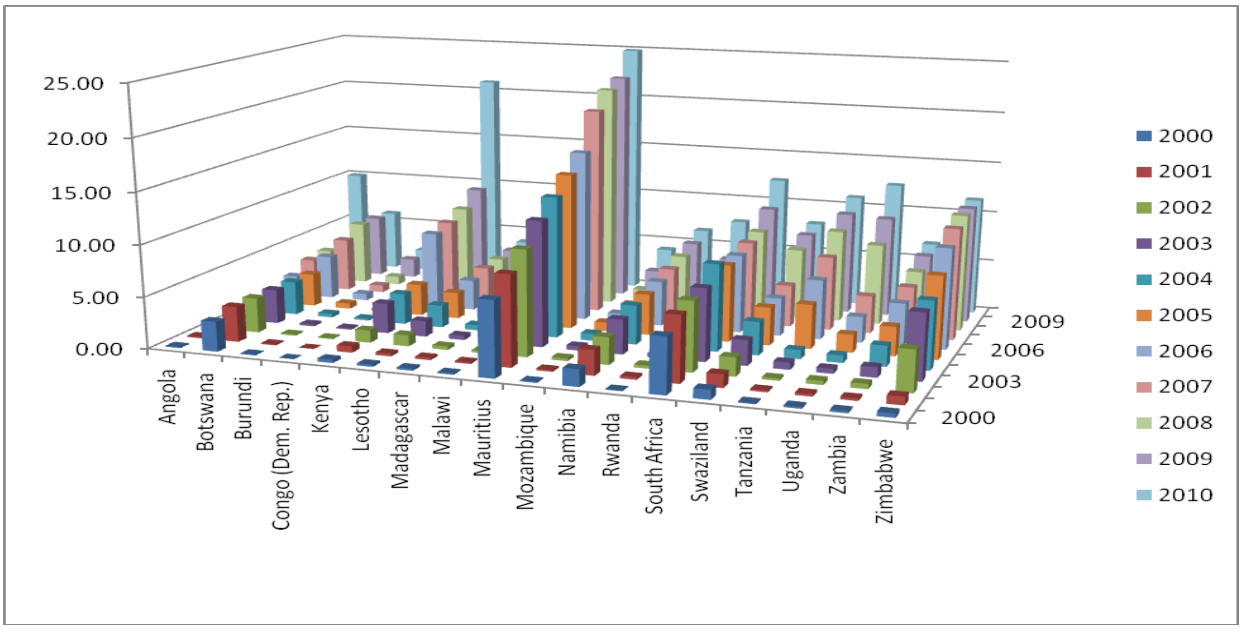
In conclusion, NUC requires compliance with the following broad areas as regards ODL:

- **philosophy** (e.g. accessibility, flexibility and lifelong learning)
- **objectives of the programme**
- **admissions** to meet the minimum national requirements for university admission
- **curricula to be streamlined with clarity**
- **pedagogy with well-defined learning objectives**
- **learning resources** to be tailored to ODL
- **adequate and suitably qualified staff** for programme leadership, resource and assessment generation, and tutor monitoring
- **academic learner support** which should be in the adequate tutor:student ratio, normally 1:50, etc.
- **information, advice and guidance (IAG)** which should be consistent with institutional policy and learner support frameworks that reflect national policy and best practices
- **administrative support for academic programmes**
- **efficiency**

4.5 ICT developments in Zimbabwe and Southern Africa

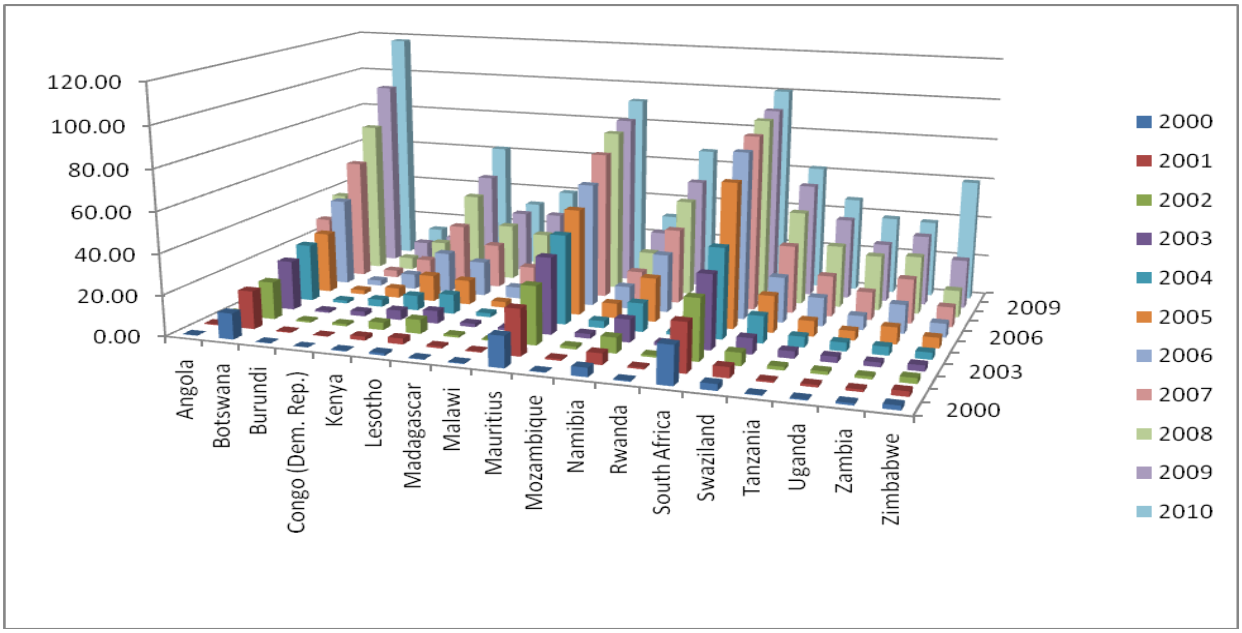
Data on infodensity was obtained from the International Telecommunications Union (ITU 2011, http://www.itu.int/en/publications/), and the analysis is shown below in Figures 3 and 4. The number of internet users per 100 inhabitants (%) by country for the 18 East and Southern African countries was analysed for the period 2000−2010 and is shown in Figure 3. Mauritius has the highest number of internet users per 100 inhabitants (%) followed by Kenya and South Africa. Zimbabwe has about a 10% internet penetration rate.

Figure 3: Number of internet users for East and Southern Africa (2000–2010)



The number of mobile users for the 18 countries for the period 2000 to 2010 is shown in Figure 4 below. Botswana has the highest mobile density followed by South Africa and Mauritius. The mobile density of Zimbabwe more than doubled from 24% in 2009 to 60% in 2010.

Figure 4: Number of mobile users for East and Southern Africa (2000–2010)



The mobile density for Zimbabwe was at about 62% in March 2011. The mobile density for Zimbabwe rose astronomically between 2008 and 2010, and this has been one of

the highest growth rates for mobile density among the 18 countries. This tremendous growth in ICTs is conducive to supporting e-learning.

5. Conclusion

There is an increase in public accountability for higher education which compels institutions to demonstrate quality within the programmes and processes, including those provided online. NOUN's vision and mission statements set out its aims for providing a high-quality student learning experience. Its Quality Assurance Framework supports these aims and objectives by specifying the responsibilities and procedures by which the standards of the academic programme and the quality of the student learning experience are managed, assured and enhanced.

NOUN supports the establishment of continental frameworks (including standards, tools and instruments) for quality assurance and accreditation for ODL and e-learning. This will ensure quality collaboration among ODL institutions. The greatest impact of the national regulatory framework for ODL and e-learning on access, skills development, employability, mobility of graduates and sustainable development is on quality assurance. The students and alumni support the establishment of continental frameworks (including standards, tools and instruments) for quality assurance and accreditation for ODL and e-learning. Establishing continental assurance accreditation and frameworks will improve and promote the development of African open distance learning. However, NUC should be more actively involved in helping universities remedy identified deficiencies in their programmes by canvassing for the provision of requisite funds and resources for "special needs" programmes and/or universities.

The regulatory authority of Nigeria, NUC, has one of the best regulatory frameworks in the world that promotes quality ODL programmes. The Zimbabwe Open University (ZOU) can learn through adaptation and customisation from the experiences of Nigeria and apply this knowledge to Zimbabwe. ICT development in Zimbabwe shows one of the fastest growth rates in Africa and is conducive to e-learning. It is feasible that materials science education be taught in Zimbabwe through ODL and e-learning, guided by the best practices and experiences of Nigeria. The AVU experience is worth considering. However, courses on nanotechnology would require extensive use of ICTs, especially in computer graphics and animation.

References

Bacsich, P. (2004) Introduction to virtual universities and e-universities, chapter one in the book *The e-university compendium - volume one: cases, issues and themes in higher education distance e-learning.*
http://www.matic-media.co.uk/ukeu/**EUNI**-**chap01**-**VUsandEUs**-2004.doc.

Council for Higher Education Accreditation [CHEA]. (2002*). Accreditation and assuring quality in distance learning. CHEA monograph series 2002, number 1*. Washington, DC: Author.
Council of Regional Accrediting Commissions [CRAC]. (2001). Best practices for electronically offered degree and certificate programs. http://www.wiche.edu/telecom/Article1.htm.

Hill, Y & Lomas, L. (2003) Students' perceptions of quality in higher education. *Quality Assurance in Education* 11(1): 15–20.

Hong Kong Council for Accreditation of Academic and Vocational Qualifications [HKCAAVQ]. (2007) *Code of practice for non-local courses recommended by the Hong Kong Council for Accreditation of Academic and Vocational Qualifications* (December 2007). Hong Kong: Author.

International Organization for Standardization [ISO]. (2007) ISO/IEC FDIS 24751 http://www.iso.org/iso/en/CombinedQueryResult.CombinedQueryResult?queryString=e-learning.

Lagrosen, S & Seyyed-Hashemi, R. (2004) Examination of the dimensions of quality in higher education. *Quality Assurance in Education* 12(2): 61–69.

Moore, MG & Kearsley, G. (1996) *Distance education*. Belmont CA: Wadsworth.

Owlia, MS & Aspinwall, EM. (1996) A framework for the dimensions of quality in higher education. *Quality Assurance in Education* 4(2): 12–20.

Pond, WK. (2002) Distributed education in the 21st century: implication for quality assurance. *Online Journal of Distance Learning Administration* 5(11). www.westga.edu/~distance/ojdla/summer52/pond52.html.

Quality Assurance Agency [QAA]. (2002). *QAA external review process for higher education in England: operation description (03/02)*. Gloucester: QAA.

Ramon-Yusuf, S. (2011) *The role of the National Universities Commission in quality assurance in Nigerian Universities*. National Universities Commission publication, Federal Government of Nigeria policy document.

Russell, TL. (1996) The 'no significant difference phenomenon' Parts 1−3 (1945−1995). http://tenb.mta.ca/phnom.html.

Shelton, K. (2011) A review of paradigms for evaluating the quality of online education programs. *Online Journal of Distance Learning Administration* IV(I), Spring 2011. University of West Georgia, Distance Education Center. http://www.westga.edu/~distance/ojdla/spring141/shelton141.html

Usoro, B & Abid, A. (2007) Delivering quality higher education through e-learning: a conceptual view. http://www.GMD-FIT/Wolfgang Prinz.

Valley City State University [VCSU]. (2006) *Technology education 660 design for engineering unit 8 reading assignment*. http://www.vcsu.edu

Verduin, JR & Clark, TA. (1991) *Distance education: the foundations of effective practice*. San Francisco, CA: Jossey-Bass.