

SCIENCE EDUCATION THROUGH OPEN AND DISTANCE LEARNING AT NATIONAL OPEN UNIVERSITY OF NIGERIA

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ABSTRACT

Open and distance learning (ODL) has become widely accepted as an alternative medium for the teaching and learning of many disciplines including science. The use of multi-media for transactions has made open and distance learning effective in the delivery of courses requiring intensive practical and face-to-face interactions. Despite the potentials of the media and the self-learning nature of the study materials/ practical manuals, many obstacles have been encountered in teaching practical based courses in science. This paper discussed the challenges of teaching and learning science courses through open and distance learning at National Open University of Nigeria. Recommendations were made for the provision of adequate instructional materials, science laboratories and training of tutorial facilitators.

KEYWORDS: National Open University of Nigeria, Open and Distance Learning, Science Education

INTRODUCTION

Science education has been recognized worldwide as a pre-requisite in technological development. It is almost impossible today to live a full and satisfactory life with little or no knowledge of science. This is because science education has introduced a lot of changes in our world and it will continue to do so in the future (Orukotan, 2007). Science education remains a very potent factor that promotes national development. Thus nations are classified as developed or developing based on their science and technological know-how which in turn determines the level of socio-economic and industrial development. Akpan (2008) opined that science contributes to the quality of life in such areas as health, nutrition, agriculture, transportation, material and energy production and industrial development. He went further to state that science education ensures that the air we breathe and the water we drink are life sustaining, and not vectors of disease and decay. Without science education, information and communication technology would be impossible. Science and technology will not be possible without science education, for example; Engineering, Medicine, Architecture, Nursing, and so on will not be practicable if there is no one to teach the core subjects such as; Biology, Physics, Chemistry and Mathematics needed for these courses. It is science and technology that has enabled human beings to exploit and utilize plants and animals as well as mineral resources in the environment to produce consumer goods and thus generate wealth. Today Nigeria is a rich country due to the application of science and technology to exploit her mineral resources.

That science and technology is at the centre of improvement in the quality of life needs no further emphasis. What should be emphasized is that scientific knowledge, skills, abilities and attitudes must be made available and accessible to all citizens from generation to generation (Okeke, 2007). This can only be achieved through science education.

WHAT IS SCIENCE AND SCIENCE EDUCATION

Science is the systematic study of nature and natural phenomenon in order to discover their principles and laws.

(Urevbu 2001). There are several definitions of science. Science can be defined in terms of its processes or its products. When defined as a process, science involves observing, classifying, measuring, experimenting, questioning, hypothesizing, recording, controlling variables, interpreting data and communicating. As a product, science is an ordered body of knowledge in form of concepts, laws, theories and generalisations. Over the years these have become formalized into systematic bodies of knowledge in the fields of biology, chemistry, physics, and geology and so on. These bodies of knowledge have to be transmitted from one person to another and from one generation to another. The process of transmitting scientific knowledge can only be done through education - in this case science education.

Science education deals with sharing of science content and process with individuals who are not considered traditionally to be members of the scientific community, the individuals could be students, farmers, market women or a whole community (Kola, 2013). According to Okeke (2007), science education is an integrated field of study which considers both the subject matter of science discipline such as biology, chemistry, physics, agriculture etc as well as the processes involved in the learning and teaching of science. It can be said to embody all education processes aimed at providing unlimited opportunities for learners to understand and utilize necessary knowledge, skills and attitudes required to operate effectively in a scientific and technological society. In other words, science education implies exposing learners' usually prospective teachers of science to scientific and technological knowledge, to the nature of science and scientific processes, to scientific attitude as well as equipping them with professional skills of a science teacher. There is a thin line separating science education and education in science. Education in science refers primarily to understanding and application of scientific concepts and principles, while science education includes the development and acquisition of processes required to assist others acquire scientific and technological knowledge.

Science education equips teachers, learners, and the society with knowledge, skills, and equipment and freedom to perform noble tasks useful for improving socio-economic standards (Lewis 1985). Science education courses are designed to produce capable scientists who can contribute meaningfully to national development. In Nigeria, science education concentrates on the teaching of science concepts, methods of teaching and addressing misconceptions held by learners regarding science concepts. At the higher education level science education can be acquired either in conventional universities and colleges of education through face to face interaction or through open and distance learning in distance learning institutions.

CONCEPT OF OPEN AND DISTANCE LEARNING

There are several approaches in defining the concept of open and distance learning. According to UNESCO (2002) and COL (2000) the term open and distance learning represent approaches that focus on opening access to education and training provisions, freeing learners from the constraints of time and place and offering flexible learning opportunities to individuals and groups of learners. Open and distance learning is an educational process in which all or most of the teaching is conducted by someone geographically removed from the learner, with all or most of the communication between the teachers and learners being conducted through electronic or print media (Creed 2001). The 'open' nature of distance learning is formally institutionalized in such policies as open admission, and freedom of selection of what, when and where to learn. The openness of distance learning is also visible in the relatively flexible organizational structure, delivery and communication patterns as well as the use of various technologies to support learning. Thus the concept of open and distance learning implies an educational approach designed to reach learners in their homes, shops, offices etc, provide learning resources for them to qualify without attending formal classes in person or create opportunities

for lifelong learning no matter where or when they want to study. The characteristic features of open and distance learning has been identified by Hulsmann (1997) and COL (2000) as follows:

- Separation of teacher and the learner in time or place or in both time and place.
- Influence of an educational institution necessary for institutional accreditation of programmes and courses.
- The use of technical media courseware such as; print, radio and television broadcast, video and audio cassettes, computer based learning and telecommunications.
- The provision of a two-way communication allowing for interaction between learners and tutors either synchronously or asynchronously, as opposed to passive receipt of broadcast signals.
- Possibility of face- to- face meetings for tutorials, learner-learner interaction (self help groups), library study, laboratory and practice sessions.
- Use of industrialized processes, that is in large scale open and distance learning operations, labour is divided and tasks are assigned to various staff working together in course development teams.

NATIONAL OPEN UNIVERSITY OF NIGERIA

The practice of open and distance learning in Nigeria has come to stay with the resuscitation of the single mode Open University of Nigeria (established by the Act of 1983) as the National Open University of Nigeria (NOUN) in 2002. National Open University of Nigeria is the only university in Nigeria that operates entirely through the open and distance learning mode. It was set up to make quality education accessible to all who desire it through a flexible and affordable distance education programme. Some of the objectives of the university include:

- To ensure equity and equality of opportunities generally but specifically in university education.
- To provide a wider access to education generally but specifically in university education in Nigeria.
- To enhance education for all and lifelong learning.
- To provide flexible but qualitative education.
- To provide educational resources via intensive use of information and communication technology (NOUN 2007).

In order to achieve these objectives and bring education to the doorsteps of people, NOUN has established sixty-seven (67) study centres across the country. These study centres are equipped with a variety of multimedia facilities to enable the learners study at their own pace. Some of this multimedia include; study materials on CD-ROMs, audio and video cassettes, internet facilities, computer conferencing, radio broadcasts, and study materials in print and tutorial facilities. (NOUN PROFILE 2014)

The University offers various programmes under the following Schools:-School of Agricultural Science, School of Arts and Social Sciences, School of Management Sciences, School of Education, School of Health Sciences, School of Law, School of Science and Technology and School of Post Graduate Studies

The School of Education runs the following undergraduate programmes in science education namely B.Sc. ED. in Agricultural Science, Biology, Chemistry, Integrated Science, Mathematics, Physics and Information Technology for

teachers. The School also offers Masters Degree in Science Education.

The School of Science and Technology offers undergraduate programmes in science namely, B.Sc. Agricultural Extension and Management, Computer Science, Data Management, Communication Technology, Mathematics, Community Health, Biology, Chemistry, Physics, Environmental Studies and Resource Management. Information Technology (with internet application) is offered at the Masters level (NOUN PROFILE 2014). Students studying science education must register for the corresponding science courses in the School of science and technology. So far thousands of students have successfully completed their programmes in science and science education in the university. The mode of instructional delivery and student support services provided in all the science courses are more or less similar, hence these are discussed together.

MODE OF INSTRUCTIONAL DELIVERY IN NOUN

The university ensures that students studying science courses are provided with all the print and electronic media they need to study at their own time and location. The university uses print, audio-cassettes, CD-ROMs, radio broadcasts and occasional face-to-face tutorials to teach the learners. Each student on registration receives the appropriate study materials/practical manuals for the courses registered. Each book is written in modular format and is divided into several units. The units containing the practical/laboratory work is designed in step by step fashion with illustrations, drawings and examples to enable students carry out exercises in their home environment or in nearby farms /fields. A science laboratory manual has also been developed for use of science education students in the school of education. These courses are also recorded on CD-ROMs, and in audio cassettes. All the courses are available on the university's website – www.noun.edu.ng. These courses are accessible to all students and the general public at no extra cost and can be downloaded from the internet. Effective transfer of skills in any science or technical work to students requires hands-on-experiment and human interaction, hence NOUN also uses face-to-face tutorial services to support students in theoretical and practical experiments. This is done under the supervision of subject specialists appointed on part-time basis. At NOUN they are referred to as facilitators. These facilitators promote students learning by stimulating discussions and encouraging students to participate. Tutorial facilitation takes place in most of the science courses, especially 100 and 200 level courses. The recent introduction of “noun i- learn” platform has also provided students more opportunities to interact with the facilitators online. However students' participation in the tutorial sessions is not mandatory, hence there is a high rate of absenteeism.

Practical sessions take place in laboratories at the study centres or in laboratories of adjoining universities. National Open University of Nigeria (NOUN) has entered into Memorandum of Understanding (MOU) with many universities so that her students can use their laboratories for practical sessions. For instance NOUN has an MOU with University of Nigeria Teaching Hospital Enugu, and Nnamdi Azikiwe Teaching Hospital Nnewi for practical exercises of B.Sc. Nursing students in Enugu and Awka study centres respectively.

In summary instructional delivery is conducted through specifically designed packaged study materials, NOUN radio, CD-ROMs, audio cassettes, internet complimented by face –to- face interaction. NOUN students will soon be able to access all library and information materials through the National Virtual Library project that will soon be launched. All these are intended to produce skilled and knowledgeable scientists and science teachers.

However, despite the potentials of the multimedia and the self –learning nature of the study materials and the

practical manuals, science education in NOUN is faced with a lot of challenges.

CHALLENGES OF TEACHING AND LEARNING SCIENCE IN NOUN

Several distance educators have found that print media dominates in the delivery of content materials to open and distance learners and also in communicating with instructors. (Butcher 2003, Tooth 2000). Research studies (Yusuf and Falade 2005, Nnaka 2012) have also shown that open and distance learners enrolled in NOUN programmes use mainly print media for instructional delivery. The science courses are no exceptions, despite the critical role that hands-on experiments play in the teaching and learning of science. Owoyemi and Akinsete (2012) in their study on “learning science at a distance –NOUN students’ perception of practical work in learning science” found that the students were of the opinion that it is more challenging to learn science without any practical work. Their study also revealed that NOUN students were of the view that it is essential for a science course to include practical sessions even though the course materials have been delivered to them. Practical work is an essential component of science teaching and learning, both for the purpose of developing students’ scientific knowledge and that of developing students’ knowledge about science (Millar 2004).

Some of the challenges of teaching and learning science education in NOUN include:-

LACK OF INFRASTRUCTURE

This has constituted a major challenge to the use of more sophisticated multimedia for instructional delivery in science education in NOUN. The following examples will illustrate the magnitude of this challenge-

- The television can be used to communicate information live to a large number of people or in recorded audio-visual form. It has been successfully used in open and distance learning programmes in South Africa, India and China. Television programmes can be used to emphasize the experimental sides of science by demonstrating the use of complex equipment and by leading students through experimental and pedagogical procedures. However there is no functional dedicated television station for open and distance learning in Nigeria. Nnaka (2012) in her study on availability and utilization of multimedia by open and distance learning students in NOUN found that television instruction was not available to the students in the study centres.
- Teleconferencing is a good open and distance learning instructional strategy that enables learners to get connected simultaneously so that interaction takes place even though participants are physically apart. It aids in minimizing learner instruction by creating a learning environment that is similar to face-to-face instruction. This facility is not in use in NOUN.
- Available evidence and visits to some NOUN study centres reveal that they lack the physical infrastructure to accommodate science laboratories.

INTERNET CONNECTIVITY

This has also posed a challenge to the teaching and learning of science through open and distance learning in NOUN. This is because access to the internet is generally very poor in the country and students in the rural areas never get access to the internet. Moreover the cost of accessing the internet is very high in Nigeria. Most students make use of the cybercafés who charge between N100.00 and N150.00 per hour despite their poor services and slow rate of their server.

Research has shown that most of NOUN study centres do not have internet connectivity (Nnaka 2012). This implies that any instructional media that requires the use of the internet cannot be utilized at such study centres.

ELECTRICITY INSTABILITY

Electricity supply which is a perennial problem in Nigeria has been a major setback for our technological development. The absence/poor electricity supply creates problems of integration of ICT tools (internet, email, television, computer etc.). Erratic supply of electricity and power outage constitute serious obstacle to effective science education through open and distance learning.

High cost of Software –The high cost of software and its licence is another serious challenge to instructional delivery of science courses in NOUN. The appropriate software for the teaching and learning of science through open and distance learning is usually very expensive because they are not developed locally. They are developed in Europe and other developed countries, and are usually made to suit their environment. In short, the software that is appropriate and culturally suitable to the Nigerian education system is in short supply.

Poverty –Inequality of access to the available technology by all the students is another challenge to science education through open and distance learning. The cost of personal computer (PC) and laptops have remained high in Nigeria. Their prices are beyond what the average worker or student can afford. Moreover the few students who are able to afford PC/Laptops are not connected to the internet, since this means additional cost which many cannot cope with.

RECOMMENDATIONS

- NOUN should adopt a “media mix”-namely interactive and non-interactive media, electronic media, and print material. The use of television instruction, videoconferencing, teleconferencing and Worldwide web applications need to be introduced into the instructional delivery mode for science education. These communication and technology devices will ensure that the delivery of science education through open and distance learning is effective and efficient.
- All NOUN study centres should be equipped with functional internet facilities, so that students and tutorial facilitators can make use of any multimedia facility that is available.
- It is necessary for NOUN to partner with information and communication technology companies in the country to assist students to acquire their own personal computers/laptops.
- NOUN study centres that have adequate physical infrastructure should have fully equipped science laboratories.
- Frequent review and strengthening of existing Memorandum of Understanding (MOU) for students practical work with conventional universities is critical, to ensure that it is working.
- Training and re-training of science tutorial facilitators on the use of various electronic media for instructional delivery, whether online or face-to-face interaction.

CONCLUSIONS

With the establishment of the National Open University of Nigeria, open and distance learning system has come to be accepted as an alternative mode of acquiring higher educational qualifications. Through this system one can

effectively pursue any programme of study at NOUN including sciences. However, pursuing a programme in science in NOUN is faced with a lot of challenges. In order to meet these challenges there is need to integrate the use of technologies such as, computer conferencing, television broadcasts, and so on into the instructional delivery method so as to produce knowledgeable and skilled scientists and science educators. Finally government should improve funding to NOUN and also improve power supply in Nigeria.

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