

INFRASTRUCTURAL CHALLENGES TO THE STUDY OF PHYSICS IN TERTIARY INSTITUTIONS

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Abstract

Infrastructures are the basic facilities, installations and services needed for the functioning of a system. This paper examines the infrastructural challenges to the study of physics in tertiary institutions of Nigeria using Katsina State tertiary institutions as a case study. Data for the study were generated through visits to the institutions to examine the infrastructures put in place for the study of physics, which was complemented by interviews. This reveals that there are many challenges in terms of lecture rooms and furniture, library services, laboratory installations and apparatus, electricity, gas and water supply and maintenance and upgrade of infrastructures etc. it is therefore recommended that these challenges should be tackled for better quality study of physics in the tertiary institutions of the state and the nation in general for national development.

Keywords: Infrastructures, challenges, physics, tertiary institutions

Introduction

Infrastructures are the basic facilities, services and installations that are needed for the functioning of a system. Infrastructure include buildings, water and power supplies, transport, administrative system etc. infrastructural facilities are vital resources that facilitates all round development of man and his environment. One vital infrastructural aspect that needs to be vigorously developed is the educational infrastructure (Jonathan and Kayode, 2010). Infrastructural challenges are the difficult tasks that arise in the functioning of systems such as education. Education involves studies of different academic disciplines at the higher levels one of which is the study of physics. Physics is the science of matter and energy and of interactions between two grouped in traditional fields such as acoustics, optics, mechanics, thermodynamics and electro-magnetism, as well as in modern extensions including atomic and nuclear physics, cryogenics, solid state physics, particle physics and plasma physics (Yahoo, 2011).

Physics is studied in tertiary institutions in Nigeria. These tertiary institutions are

institutions of higher learning that provide education beyond the level of secondary schools in Universities, Colleges, Polytechnics and many other institutions. The study of Physics in tertiary institutions of developing countries like Nigeria is facing challenges, one of which is infrastructures. These challenges have to be tackled for national development as physics has direct relevance in the nations quest for scientific and technology development and indeed overall national development. This paper therefore aims at examining how to tackle the infrastructural challenges to the study of physics in tertiary institutions with particular reference to Katsina State, Northern Nigeria.

Methodology

The methods used to collect data for the study include field visits for physical observation of the infrastructures in the institutions sampled for the study. Those considered are Universities, Colleges of Education and Polytechnics where physics and Physics course units are studied. A total number of 08 higher institutions were listed which can be seen on table 1 below.

Table 1: Tertiary Institutions in Katsina State

S/N	Name of Institution	Year Founded	Ownership	Programmes of Study
1	Federal College of Education, Katsina	1976	Federal Government	NCE, B.Sc Ed
2	Hassan Usman Katsina Polytechnic, Katsina	1983	State Government	OND, HND, NCE,
3	Isah Kaita College of Education, Dutsinma	1991	State Government	NCE, IJMB, Matric
4	School of Basic and Remedial Studies, Funtua	2002	State Government	Remedial, IJMB
5	Yusuf Bala Usman College of Legal and General Studies, Daura	2004	State Government	Diploma, NCE, Higher Diploma
6	Katsina University, Katsina	2005	Islamic Foundation	B.A Degree, B.Sc Degree
7	Umaru Musa Yar'adua University, Katsina	2007	State Government	B.A Degree, B.Sc Degree, Msc Degree
8	Federal University, Dutsinma	2011	Federal Government	B.Sc Degree

Source: Field Work (2014)

Five (05) out of the eight (08) institutions in the table above were purposively sampled for the study. Those sampled include Federal College of Education (FCE) Katsina, Hassan Usman Katsina Polytechnic (HUK) Katsina, Isah Kaita College of Education (IKCOE) Dutsinma, Katsina University Katsina (KUK) and Umaru Musa Yar'adua University (UMYU) Katsina. These five institutions were visited to physically observe the infrastructures put in place for the study of physics. The infrastructures include lecture rooms, and their furniture, library services, laboratories, their installations and apparatus, electricity, gas and water supplies, to the laboratories and the maintenance and upgrade of the infrastructures. Interviews were conducted

with the Heads of Departments of Physics, physics lecturers, laboratory technicians and students of physics in the institutions. The interview questions are on the infrastructures put in place for the study of physics as listed above.

Besides these two sources data was also collected from literary materials from textbooks, journal articles, conference papers and paper printed online are used in writing the paper.

Results and discussions

The study of physics in the institutions Physics and physics course units are among the science programmes studied in the tertiary institutions. These can be seen in the table below.

Table 2: Physics/Physics course units in tertiary institutions of Katsina State

S/N	Institutions	Physics/physics course units
1	Umaru Musa Yar'adua University, Katsina	B.Sc Hons Physics B.Sc Ed. Physics
2	Katsina University Katsina (Islamic University)	B.Sc Physics Mechanics, Electricity and Light (B.Sc computer sciences 100 levels)
3	Federal College of Education, Katsina	Physics (Pre-Degree) NCE Physics/Computer NCE Physics/Maths NCE Physics/Inter. science B.Sc Ed. Physics
4	Isah Kaita College of Education, Dutsinma	NCE Physics/Computer NCE Physics/Maths NCE Physics/Inter. science Physics (IJMB & Matric)
5	Hassan Usman Katsina Polytechnic, Katsina	Physics (CSLT, Pre-ND and IJMB) Electricity and Magnetism, Optics and Waves, Thermodynamics (ND SLT) Mechanics and Properties of Matter (NCE I Tech. Education, ND I Architecture) Optics, Waves, Electricity & Magn. (ND I Agric.)

Source: Field Work (2014)

From the table it could be seen that UMYU runs B.Sc honours and B.Sc Education Physics degrees. At KUK, B.Sc Computer Science Students study one physics course unit. B. Sc Physics has started from 2013/2014 session at KUK. At IKCOE Dutsinma and FCE Katsina they run NCE programmes in physics combined with other science disciplines. FCE Katsina has recently started B.Sc Ed. Physics. In ISKCOE there are IJMB and Matric students that study physics in preparation for degree programmes in the universities. In HUK polytechnic, there are many physics course units in Certificate, Pre-National Diploma, National Diploma and NCE Technical Education programmes.

These institutions have put in place infrastructures to enable the study of physics. However, there are infrastructural challenges to the study of physics in these tertiary institutions. In UMYU however these challenges do not exist. This is because the university has three standard, new wooden type laboratories with cupboard to keep and display apparatus. The laboratories are fully equipped with modern apparatus/instruments, many are even in the store

for future use. The laboratories are fully air conditioned with steady power, gas and water supply and adequate stools for students to sit during practicals. The institution is clearly favoured when compared to other state owned institutions.

Infrastructural challenges to the study of physics

- i) **Lecture rooms and furniture:** In the institutions the lecture rooms could not comfortably accommodate the large number of students admitted. In KUK for example, the number of B.Sc Computer students is 138, in HUK polytechnic the number of two Pre-ND groups are 206 and 208 while ND I SLT has 159 students. The class room furniture are also not adequate for students to sit due to the large number. The lecture room ceilings at IKCOE Dutsinma have fallen down in many of the classes in the institution. In KUK, FCE Katsina

HUK Polytechnic Katsina broken furniture were seen in lecture rooms.

- ii) **Library Services:** Well equipped libraries stocked with new and latest textbooks and journals are important for the study of physics. In FCE Katsina the students interviewed complained that the books in their library are old editions while in IKCOE Dutsinma, the students complained of difficulty in finding physics textbooks as the books are mixed with the other science books. In the same institution (IKCOED) the students complained of few internet centres in Dutsinma town as a whole, which could assist them in searching for relevant textbooks and journals. In HUK Polytechnic, Katsina there is inadequate textbooks for the use of the students in the library. There are also no textbooks on Electricity and Thermodynamics in the circulation section of the library (Isah, 2011).
- iii) **Laboratory installations and apparatus:** The B.Sc Computer Science students of KUK did their practical for Mechanics, Electricity and light for 2010/2011 session (2nd semester) at the physics laboratory of HUK Polytechnic. This was after an application requesting for the use of the laboratory has been approved by the polytechnic. Also during the first semester of 2010/2011, the physics laboratory technicians borrowed some apparatus (spiral springs, masses, hangers etc) from UMYU. This shows that there is some level of cooperation in the use of infrastructures between the institutions.

During field visit to the laboratories of the institutions it was observed that the laboratory of IKCOE Dutsinma is in a dilapidated condition as most of the installations

and facilities are in state of disrepair. The apparatus in the laboratory are fairly enough for the students. In FCE Katsina, the laboratory is small and in need of a facelift. Some of the facilities (e.g. sitting tools) are not adequate and thus have to be moved around between the Physics and Chemistry laboratories

In HUK Polytechnic, the laboratory is the concrete type, though moderately big could still not accommodate the large number of students especially Pre-ND. Lecturers interviewed in the institution complained of inadequate apparatus e.g. Ammeters and voltammeters.

- iv) **Electricity, gas and water supply:** These facilities are needed in the Physics laboratory for the conduct of practical. In terms of electricity, the four institutions with the exception of IKCOE are located along the same road that enjoys better electricity supply compared to Katsina city. The laboratories are linked to stand-by generators in case of power failure. In IKCOE Dutsinma, students interviewed complained of interrupted power supply to the physics laboratory and the laboratory has only 800VA tiger generator which is clearly not adequate for the large laboratory.

There is gas supply to all the laboratories. But at IKCOE Dutsinma and FCE Katsina, some of the gas fittings are broken and thus non-functional. In HUK Polytechnic, there adequate water supply as the laboratory has tank behind it with water fittings in place. This situation is however not the same at FCE Katsina and IKCOE Dutsinma where the water fittings such as pumps are broken and thus could not supply

water to the laboratories during practicals.

- v) **Maintenance and upgrade of infrastructure:** In HUK Polytechnic Katsina maintenance of infrastructures are carried out after some time by the Estate Department of the Polytechnic. In terms of upgrade, recently the Head of Department Basic and Applied Sciences purchased 12 new ammeters voltmeters to replace the old ones in the laboratory.

In FCE Katsina, observations on the laboratory have clearly indicated that there is no routine maintenance as many of the electricity, gas and water fittings were broken and in state of disrepair. However as part of the upgrading of infrastructures in the College, a new science complex is under construction.

In IKCOE Dutsinma, the lecture rooms and Physics laboratory shows that the maintenance of facilities is poor as some of the facilities in the classrooms and installations in the laboratory could be seen broken, out of service or even detached from where it belongs. The classrooms and laboratory are in need of maintenance and upgrade for better services.

The situation at FCE Katsina, IKCOE Dutsinma and to some extent HUK Polytechnic, Katsina is the same with what is obtained in institutions of higher education in Nigeria where most of the facilities are dilapidated and in poor condition that suggests lack of maintenance for a long time (Uche *et al.*, 2011).

The role of physics in national development

The role of Physics in national development is vast and there are many ways that Physics helps; Physics is the most basic of sciences and its

concepts and techniques underpin the progress of all other branches of sciences (Murenzi, 2006).

The study of energy and electronics in Physics assist in the production of renewable sources of energy in the country. Renewable energy offers answers to sustainable development in Nigeria in view of the uncertain energy scenarios across the country which has impacted negatively on the nation's development (Bugaje, 2008).

Solar energy physics has direct relevance to agricultural production as it can be applied to areas of water pumping for irrigation, solar hot air crop drying and in livestock and dairy farming, agricultural sprinklers, potable crop sprayers and grain milling (Musa, 2007). Also the study of Mechanics in Physics is relevant to agricultural mechanization which is needed in Nigeria to reduce the use of human labour and increase agricultural productivity.

The study of Nuclear Science and Technology in Physics can be used in improving agricultural practice in Nigeria as Nuclear Technology in parts of the world had revolutionized agricultural practice to meet the need and desire for food production without degrading the environment (Rabiu and Bishir, 2011). Food irradiation in Physics had aided in post harvest technology through less spoilage processes for export and future usage of produced crops, meat, fishes etc (Rabiu and Bishir, 2011).

Atmospheric Physics has direct relevance to the operation and safety of air transportation. Air Traffic Controllers in control Towers of Airports uses their knowledge of Physics to guide airplanes landing and taking off at airports. The contribution of air transportation to business and economy is immense. Furthermore researches in Atmospheric Physics contributed to the development of cosmic radio waves, satellite communication and modern receivers and detectors (Ubachukwu and Okeke, 2000).

In the field of medicine, X-rays discovered by Physicists are used to take images of the structures of patients in hospitals. X-rays and other forms of radiation are used in the treatment of diseases like cancer. Similarly, ultra sound is used to scan human body for diagnosis. The

knowledge of Physics is also used to detect and correct eye defects (Umar, 2005).

Computers and internet are examples of technology that is based on knowledge of Physics. The first electronic digital computers were built in the basement of the Physics Department of Iowa State University in 1939 in USA (Bildloss, 2010). Physics is thus a cross-cutting discipline that has application in many sectors of national development including agriculture, water supply, health, transport, energy production and information technology.

Recommendations

The following recommendations are made in order to tackle the infrastructural challenges facing the study of physics in tertiary institutions in Katsina state.

Katsina State Government should build more lecture rooms and lecture theatres in the three institutions it owned to comfortably accommodate the large number of the students that are admitted yearly into these institutions. Katsina State Government should be fair to the other tertiary institutions it owns in the provision, maintenance and upgrading of infrastructural facilities. All the tertiary institutions should get their fair share of infrastructures rather than favouring UMYU only. There should be further cooperation between the institutions in the use of infrastructures such as laboratories and apparatus, especially as four of the tertiary institutions selected for the study are located along the same road close to one another.

The Katsina State Government should raise funds that would help to improve and sustain the quality of education in the tertiary institutions of the state through infrastructural maintenance and upgrade. Science laboratories in the tertiary institutions should be well managed and closely supervised to ensure that they have all the necessary apparatus, instruments and specimens to carry out their practical for quality science education in the state.

Conclusion

Tertiary institutions need to produce highly qualified professionals and intelligent academics not only for their own survival but also to

produce knowledge that can connect the institutions to both the global knowledge economy and the local community (Ingawa, 2011). However they cannot do this unless they tackle the infrastructural challenges facing the study of many programmes of study such as physics. In order to tackle the challenges, the government both federal and state must give education the priority it deserves by maintaining and upgrading the tertiary institutions, equip the laboratories with up-to-date apparatus, provide latest books to the libraries among others (Uzokwe, 2008). Both States and Federal Government must stand up and face the infrastructural challenge facing its own tertiary institutions for quality study of Physics and other sciences in the states in particular and the nation in general. However, it has been recently observed that the Tertiary Education Trust Fund (TETFUND) has started to tackle head on these challenges which if sustained will in future ensure adequate provision of infrastructures for the study of basic sciences in general.

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