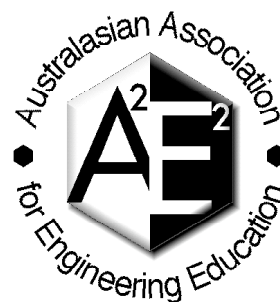


AUSTRALASIAN JOURNAL OF ENGINEERING EDUCATION



Co-Editors:

Dr Nathan Scott
Dept. of Mechanical
& Materials Engineering
The University of
Western Australia
35 Stirling Hwy, Crawley 6009
Western Australia
nscott@mech.uwa.edu.au

Dr Roger Hadgraft
School of Civil and Chemical Eng.
RMIT University
GPO Box 2476V
Melbourne, Australia 3001
roger.hadgraft@rmit.edu.au

Dr Vojislav (Vic) Ilic
College of Science,
Technology & Environment
Uni of Western Sydney,
Kingswood Campus
Locked Bag 1797, S. Penrith
DC NSW 1797
v.ilic@uws.edu.au

Published in Australia by

The Australasian Association for Engineering Education Inc

□ AAEE, 2003

ISSN 1324-5821

Permission is granted to make copies of this paper, in print or electronic form, for research, private study or educational purposes.

If you wish to reprint this paper for commercial purposes or as part of another publication or anthology, you must seek permission in writing from the Editors.

Responsibility for the contents of these papers rests upon the authors and not the publisher. Data presented and conclusions developed by the authors are for information only and are not intended for use without independent substantiating investigations on the part of the potential user.

Papers published in the AJEE have undergone a process of peer review, with each paper being formally peer reviewed by at least two independent reviewers and the decision to publish is based on these reviews.

The correct bibliographic reference for this paper should include the web address where it was published:

Australasian J. of Engng. Educ., online publication 2003-01

<http://www.aee.com.au/journal/2003/kofoworola03.pdf>

ENGINEERING EDUCATION IN NIGERIA : PRESENT LEARNING SYSTEMS AND CHALLENGES FOR THE FUTURE

Oyeshola F. Kofoworola

*Department of Mechanical Engineering
University of Lagos*

Keywords: Nigeria, Engineering Education, Learning process, Problems, Challenges, Future.

Today technology has permeated every aspect of social life and virtually everything revolves around it. For a developing country like Nigeria, engineering education thus assumes vital importance in the development of relevant technology for societal growth.

This kind of education is obtained by attendance at a tertiary institution, a university, college or polytechnic. Since technology is constantly being updated and improved in other parts of the world, the challenge of this millennium for engineering education in Nigeria requires our learning systems to undergo changes so that engineering graduates will be equipped to cope with these global changes and societal needs.

This paper will

- examine changes required to curricula, internships systems, equipment and facilities, etc.
- advance some suggestions on how to curb mediocre standards associated with proliferation of engineering institutions;
- examine the necessity of raising the level of educational preparation, which may mean higher standards for entry into practice generally, and for licensed practice in particular.

This paper advocates

- a reappraisal of the traditional approach to engineering education in Nigeria to include partnerships between universities and industries. The benefits of such partnerships are highlighted; and
- the development of professional graduate programs aimed at improving technical competence beyond undergraduate engineering level.

INTRODUCTION

The future of any nation today, not only depends on the abundance of resources which it possesses but also on the specialised skills, competence and abilities possessed by its populace which can be harnessed to utilise its natural resources. Engineering is the key to the technological, economic and societal development of any nation, because it cannot be divorced from any aspect of present day human activities.

In Nigeria, engineering is taught in the universities, which award degrees at both undergraduate and graduate levels, and in polytechnics, which award diplomas. Historically, the

first Nigerian engineers to receive formal training attended the old higher college, Yaba, in the 1940s. With the establishment of the University College Ibadan (now University of Ibadan) in 1948, Nigerians were sponsored to British Universities to train as engineers, on completion of a two-year pre-degree program at Ibadan. (Oladipo, 1994). Later, more universities such as Ahmadu Bello University, University of Lagos, etc were established in the 1960s making it possible to train engineers locally.

The number of Nigerian youths seeking education has increased in recent years and the number of universities and polytechnics has also increased. There are now forty-five Federal and State universities and a large number of polytechnics, most of which offer courses in engineering or engineering science. (Unpublished reports of Nigerian Universities Commissions accreditation panel report, 2002). At the same time it is the author's view that the standard of engineering education in Nigeria has fallen drastically.

The engineering education literature today is saturated with diverse research documentations on the various aspects of the field. Extensive research has been conducted on the application of computer to engineering education. (Abeles, T. P., 2001), how to improve the quality of education (Peel, H. R. and Quayle, M., 2001), as well as the nature of certification and licensing of graduates (Jaeger, R. M. 2002). Sadly, these novel studies have failed to consider the situation in developing countries like Nigeria. It is hoped that this article, a picture of the state of engineering education in Nigerian universities, will stimulate more research in this area of need.

FACTORS AFFECTING ENGINEERING EDUCATION IN NIGERIA

The Nigerian Universities Commission accreditation Panel's, "Quality Assurance in Nigerian Universities Report" of 1999/2000, an accreditation exercise, indicated that most of the Nigerian Universities offering engineering programs were accorded only *interim* status, a lamentable state of affairs.

The problem of low funding

Engineering schools in Nigeria are beset by:

- (i) Inadequate staffing
- (ii) Poor library facilities
- (iii) Inadequate facilities

These problems are directly caused by inadequate funding of the academic sector.

Funding for Nigerian Universities has traditionally been from grants by governments and international agencies, research donations and contracts usually tied to specific projects, consultancy and other services rendered by the university, and endowments (Akintunde, 1994).

Our first generation institutions, the ones that have existing facilities for teaching, are the most deeply affected by low funding. For example, the University of Ibadan needs about N250million per month for salaries alone, but the government provides just 42% of this amount. The University of Lagos requires at least N200 million monthly (Orangun, 2002).

Whilst engineering education in Nigeria cannot be described as substandard, it is nevertheless inadequate to completely equip students to cope with the challenges of modern day society.

The Government funding amounts are grossly inadequate to support existing staff, maintain infrastructure and facilities, much less embarking on new project which are capital intensive. Except, of course, such projects are funded by grants from international agencies.

The problem of obsolete curricula

Another problem hindering effective engineering education in Nigeria is the issue of curriculum design. The engineering education curriculum in Nigerian Universities can be said to be obsolete. This curriculum, uniform to most universities, has not been thoroughly reviewed since the British who established universities and assisted in their development (Akintunde, 1994).

The Council for the Regulation of Engineering in Nigeria has the responsibility for accrediting engineering faculties in Nigerian universities. Though it reports that curriculum is

adequate, it is apparent that Nigerian engineering students are computer deficient. For example, to the author's knowledge, computer based design packages (such as AutoCAD) are not taught in any Design programs at any of our universities. Instead, where computers would be used in developed nations, our students continue to use drawing instruments. Even the instructors are not proficient in the use of computers. This is a deficiency in our education, which can be linked directly to the lack of adequate funds for university and also exposes the need for curriculum revision.

Curriculum review and development are urgently needed, but cannot be done arbitrarily. Review must be done based on the requirements and expectations of the Nigerian society (industry, economy, etc) of our engineers. One way to achieve this is to have practicing engineers serve on advisory committees for curriculum design on engineering education. The Council for Regulation of Engineering in Nigeria (COREN) and the Nigerian Society of Engineers (NSE) has been active in this area, but sadly, their efforts have not so far brought any major improvement to the state of engineering education.

The problem of student exposure to industrial practice

The leading qualities of a good engineer are technical ability, imagination and solid judgment. Technical ability depends on technical knowledge (Akintunde, 1994). Engineering education must impart technical skill as well as financial, communication and social/political skills. Early exposures of students to technical program as well as developing their computer knowledge base will develop their creative thinking and technical skills, and help them understand easily what they are taught.

In Nigeria, engineering students gain exposure to professional engineering practice through the student work experience program (SWEP) and the student industrial work experience scheme (SIWES). These programs constitute part of the requirements for the award of an engineering degree. The SWEP program is usually conducted within the students' local university at the end of the second year and lasts for about a month. The SIWES is an exposure to industrial practice. It runs for three months at the end of the third year plus a minimum of four and maximum of six months after the first semester of the fourth year.

Sadly, the universities have not gained the cooperation of industries in the SIWES program. Students still find it difficult to get positions for industrial attachment and when they do, they are not properly supervised to ensure that they actually acquire knowledge as well as technical skills. This is partly because the industrial/manufacturing base in Nigeria is very low and also because of the reluctance of industries to allow their facilities to serve as training grounds.

The problem of staff qualifications and experience

One major problem affecting the quality of engineering education in Nigeria is the low number of Senior Lecturers with PhD qualifications. There exists presently in Nigerian universities, especially in the engineering faculties, an unhealthy situation where most of the academics belong to the junior cadre (Lecturer II, Assistant lecturers who are still learning the ropes) by virtue of their qualifications (having only Masters degree) and a small minority, of professorial rank, most of whom are fast approaching the age of retirement. Thus, a vacuum exists in the middle stratum, occupied by very few senior lecturers. How this vacuum came to be, isn't quite clear. However it is clear that if this situation persists, the standard and quality of engineering education in Nigeria will drop when the more experienced staff retire.

WHAT MUST BE DONE?

In order to ensure that engineering education in Nigeria is relevant and meets global standards, the problems identified above must be addressed.

Recognition of the importance of engineering education

At the risk of labouring a point which is no doubt clear to readers of the AJEE, Engineering Education must be seen as absolutely fundamental to the future prosperity of any nation. Let policy-makers and funding committees take note!

An engineering-based economy is a productive economy. The way to greater economic prosperity is to increase the number and quality of engineers in our society, and the way to do

that is through better engineering education.

Changes to government funding paradigm

Inadequate funding is a most serious problem. The Science and Engineering programs at Nigerian universities feel the pinch more than others because they depend on laboratory, workshop and industrial activities. (Akintunde, 1994).

All federal universities in Nigeria receive a basic level of funding from the government, which is quite inadequate. The government is proposing an autonomy bill for all federal universities and polytechnics. If this becomes law it will give our institutions more freedom to determine their affairs, including finance. The idea is that government will continue to provide a subsistence level of funding but universities are to seek the greater part of their revenue from other sources. It is expected that student fees will rise under this new funding model, however this is seen as acceptable provided money becomes available to improve the quality of teaching and research e.g. through provision of teaching aids, re-equipping laboratories and libraries.

Universities are also expected to aggressively seek industry-university cooperation. Such partnerships are expected to enhance the relevance of universities to both students and to the nation more generally. It is thought that industry collaboration will enrich lectures with practical real life problems of contemporary importance, as well as providing much-needed revenue (Tener, 1996, Videon, 1996).

Facilitation of university-industry partnerships

Government policy must be directed towards removing obstacles such as the small industrial base and the unwillingness industrialists to cooperate with the SIWES and SWEP programs.

Another benefit of university-industry partnership is in the area of staffing. A system could be developed to enable practicing professional engineers from industries to serve their community in academia, even if only on a part-time basis. This could be a way of filling the mid-career-stratum vacuum identified above. If experienced engineers can be convinced to work at the university, they will add their wealth of professional and practical experience to the development and improvement of engineering education. (Dubler, 1996).

Modernisation of curriculum through contact with industry

It is important that engineering curriculum, course content and teaching methods evolve in partnership with changes in environment and technology. Extensive educator-practitioner interaction is a vital element in maintaining the currency of the engineering program and ensuring that it achieves the needs of industry, government and society.

Advisory groups and professional activities should be a vehicle for the development of programs which enable engineering faculty and engineering practitioners to work at the student level, so that engineering education will truly be educating engineers for doing engineering.

Programs in which students work on real engineering projects provided by local engineering firms (industry) must be developed. This will expose students to all aspects of design from initial concept to the finished product.

Computer technology has led to the evolution of new fields of study and it is very likely that this trend will continue. Engineering programs in Nigerian universities must equip engineering students with necessary computer skills by making computers available at all levels for teaching, instruction and research.

There is a need to expand the horizons of the engineering graduate, in technical and leadership areas. In recent years there has been increased demand for Masters level education, so it is suggested that preferential attention should be given to improving programs at this level. This will be very appropriate for two classes of current engineering graduate: the student with a broad undergraduate program that lacks sufficient depth, and the student who is deeply interested in increase technical competence, perhaps as a result of having spent some post-BSc time in practice (Gould, Jolley, 1996).

The immediate need in industry is for graduates who are able to work in multi-disciplinary teams. This skill is seen as vital to the development of industry in Nigeria, as larger and more complex projects are attempted. Universities are expected to contribute by producing graduates

with the ability to work effectively in a complex interdisciplinary environment. This can only be achieved through increased cooperation among various university departments and, of course, industries.

Changes to licensing requirements for professional engineers

In Nigeria, licensing of engineers is done by the Council for the Regulation of Engineering in Nigeria (COREN) and the Nigerian Society of Engineers (NSE), the regulatory bodies for the Engineering profession in the country. The process entails the presentation of a written report on relevant post-graduation work experience and an assessment by examination. There is need for a new licensing model. COREN and NSE should consider the possession of a Masters degree in any engineering program as an alternative requirement for licensed practice, apart from further examination as the sole route to licensure.

This of course, would only be possible if our universities are able to satisfy accreditation requirements and our engineering students graduate from COREN and NSE accredited programs, which would provide necessary and sufficient evidence of education preparation.

CONCLUSIONS

World population is increasing and the principal managers of engineering and technology of the future are our students today. We would like to prepare these students to cope with the challenges they will meet. We must consider economic, environment, political and social matters as well as scientific and technological issues. (Kersten,1996).

The solution to our problems will require more technology, not less.

Our students need a global perspective and an understanding of the interrelationships among various sectors, for example various technical disciplines and groups in industry and society.

Engineering education in Nigeria must seek to contribute to the development of Nigeria by maintaining flexibility in our educational programs and continually adapting them to technological changes. Our programs must provide intensive course work that gives students a solid theoretical background, and research projects that involve the application of modern scientific techniques to practical, local problems.

REFERENCES:

Books

1. Orangun, C. O., Technological Innovations: The Ultimate Goal Of Engineering. Education For Development. Prof. Emeritus Adewale Adewola Memorial lecture, University of Lagos Press, Lagos. 4 - 5 (2002).

Journals

2. Abeles, T. P., The Internet and academic. IJCEELL, 11, 1/2(2001)
3. Blaschke, B. C., The educator-practitioner interface. J. Professional Issues in Engng. Educ., 98 - 99 (July, 1996).
4. Gould, P. L. and Jolley, H. D., The case for professional masters programs in civil engineering. J. Professional Issues in Engng. Educ., 100 - 110 (July, 1996).
5. Jaeger, R. M., A view back from the future: testing for credentialing in the Year 2010. IJCEELL, 1/2/3/4 (2002).
6. Kersten, R. D., Paragon or paradox. J. Professional Issues in Engng. Educ, 147 - 150 (Oct. 1996).
7. Peel, H. R. and Quayle, M., University for industry: widening participation. IJCEELL, 11, 3 (2001).
8. Tener, R. K., Industry university partnership for construction engineering education. J. Professional Issues in Engng. Educ., 156 - 162 (Oct. 1996).
9. Videon, F. F., Response to: The educator-practitioner interface. J. Professional Issues in Engng. Educ., 98 - 99 (July 1996).

Conference papers

10. Akintunde, I., Some thoughts about engineering education in Nigeria. Proc. National Engng. Conf. Lagos, Nigeria, 28 - 50 (1994).
11. Oladapo, I. O., Effective utilization of engineering personnel for national development. Proc. National Engng. Conf. Lagos, Nigeria, 23 - 26. (1994).

ABOUT THE AUTHOR

Oyeshola Femi Kofoworola is a lecturer in the Department of Mechanical Engineering, University of Lagos, Nigeria.

He obtained his Bachelor of Engineering degree in Mechanical Engineering from Ahmadu Bello University, Zaria, Nigeria in 1995 and a Master of Science degree in the same field of study from the University of Ibadan, Ibadan, Nigeria in 2001.

He has had significant working experiences in industry as a Supervisor (Tower Extrusions, Lagos, Nigeria), and as a Consulting/Resource Engineer (IAN Associates Nig. Limited, Zaria, Nigeria). He actively pursues research in Energy studies and Engineering Education.