# A PRAGMATIC APPROACH IN ENGINEERING EDUCATION TEACHING METHODS AND INDUSTRY PARTNERSHIP

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## ABSTRACT

Lack of appropriate practical skill acquisition in engineering training had been a subject of concern in developing nations. The paper examines the impact of teaching methods on the quality of graduates produced for the industries and x-rays the relevance of present engineering structure and curricula in some core engineering fields. The study shows lack of coordination in curricula development and dissemination between the institutions, industries and students. The study posited that in reforming education to benefit the industries, teaching methods should connect both resource manpower and facilities from both the industry and institutions.

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***Key words:*** *Engineering education, teaching methods, pragmatic, industry, curricula*

## 1.0 INTRODUCTION

The quality of engineering graduates from Nigerian Universities and Polytechnics has been a major subject of concern from most industries in Nigeria. Most industries complaint stem from inadequate skill requirement for most cutting edge technology, low practical knowledge and confidence. Most Nigerian engineering graduates are subjected to several re-training programme since most of the graduates are considered non-employable going by the quality of training acquired from their various institutions. The level of economic development of any nation depends on its level of human resources development, particularly in science and engineering as well as technological advancement and industrialization. Nigeria is far from experiencing any landmark in technological growth towards industrialization due to poor infrastructural status despite the huge number of graduates from various engineering faculties of universities/polytechnics that have failed to impact positively on the growth of industries for economic emancipation and industrialization. The National Universities Commission (NUC) report showed that there are 65 universities in Nigeria including 26 federal universities. 24 states universities and 23 privately owned institutions [1]. There are also 43 polytechnics made up of 17 federal and 26 state owned polytechnics [2]. However, only about 10% of graduates from these various institutions are annually employed. Various studies have queried the relevance of graduates and research results to the industry considering the low academic status and skill acquired by product from various institutions. The training programme is not addressing the growing need of the industry and society. A change of direction is required to close up the widening gap over a period of time between the engineer-in-industry and the engineer-in-academia. Change of focus will require the re-orientation and possibly the adaptation of the present engineering curricula and training to meet the indigenous demand. The UNESCO report observed that most engineering facilities in Africa are established by colonial governments and the curricula and engineering education system were modeled as such [3]. This has possible

affected the appropriate structuring of the curriculum to meet the immediate growing need of the people.

## 2.0 ENGINEERING EDUCATIONAL PROBLEM IN NIGERIA

The problem of engineering education in Nigeria include factors such as poor secondary school foundation, faulty admission policies, large students enrolment as compared to available facilities and equipment and the non-flexibility of the engineering curricula [4]. Poor secondary school foundation is due to lack of basic practical teaching tools in most elementary schools in Nigeria. In some cases, there are no laboratories. An alternate practical training and examination are used in evaluating students' performance which is based on principle of imagination rather than visual. There is no firm grasp of the natural sciences from the foundation a situation which makes the appreciation of science and engineering principles difficult in the higher schools. A massive faulty admission policy which centralizes the administration of examination by a single body known as Joint Admission and Matriculation Board (JAMB) has contributed immensely to poor classification of candidates into schools. The University Matriculation Examination (UME) is characterized with several examination frauds and the problem of enhancing Federal character through quota system. The quota system is based on the following criteria: 40 – 45% are admitted on merit, 30 – 35% are from states around the university location, 20% from educationally disadvantage states while 0 – 10% is at the discretion of the University [4]. In most cases, merit is compromised such that candidates with good score may not get admitted while average scored candidate were admitted based on this flaw criteria. Inadequate facilities and equipment for adequate engineering training have been a perennial problem. The student enrolment grows astronomically to the extent that the number of institutions and facilities can no longer cope. The Nigerian Universities Commission (NUC) is a body in Nigeria responsible for the accreditation of programmes and facilities. The body recommended maximum of 40 candidates per class per stream. A visit to many of the engineering facilities recorded 100 – 200 candidates in some of the institutions per class, per stream. This has hampered greatly the process of training towards practical skill acquisition. Some engineering facilities are also confronted with inadequate qualified teaching staff. The staff student ratio have been found grossly inadequate such that some programmes were cancelled in the last accreditation exercise for various Universities in Nigeria by NUC in 2006. Some of the professions in some of these institutions have also left for greater pastures in Europe and America. Various programmes have suffered from this massive brain train

## 3.0 FUNDING

Government funding of tertiary education has been very dismal. The government only pays little attention by providing paltry budgetary allocation for educational programmes and research less than the United Nations recommendation. These have hindered projects and infrastructure in developments of most institutions. UNESCO recommendation that 26% of national budget be allocated to education have continuously unrealized in Nigeria. Presently only 6% of national budget is allocated to education [5].

## 4.0 INDUSTRY-INSTITUTION PARTNERSHIP INITIATIVE

The industry-institutions partnership is increasingly inactive in the engineering education in several areas compared to what is obtainable in the developed world. Several blue chip industries

have had great influenced in transforming engineering education. Several reports showed IBM 1940 – 1960 mobilization of University professions to collaborate in e-commerce curricula development in year 2000 [6]. It is also reported that IBM invested over $1 million in faculty and University around to service innovation pioneers. IBM also hosted a conference on Service Sciences, Management and Engineering (SSME), a cross-disciplinary approach towards developing new services-oriented courses and curricula [6]. Cisco system, established in 1984 has provided internet protocol (IP) based network technologies with new approaches for both instructions and learning. This includes a partnership deal with 10,000 educational institutions in over 160 countries. Nokia Corporation is also working in con cert with educational institutions to create an environment for open innovation in mobile entertainment and communication area to advance mobile multimedia application development [6]. Nigeria's educational institutions are yet to reach this level of partnership. The contributory roles of most multinational s are only in assisting local farmers and provision of infrastructures. The wide gap between the two establishments is due to ineffective concert curriculum structure and colonial syndrome wherein the nation is import driven in most facets of endeavours. Government interest did not help eithe r. Most researches fund support is not properly channeled to solving industrial problems but rather abstract. Most industries problem are solved internally and widening the interactive zone between the industry and institution which should have benefited b oth sides. The University became ignorant of activities in the industry and vice versa thus resulting in the weak link as presented in fig 1. [7].The effect is the turn out of fairly baked graduates from various engineering faculties.

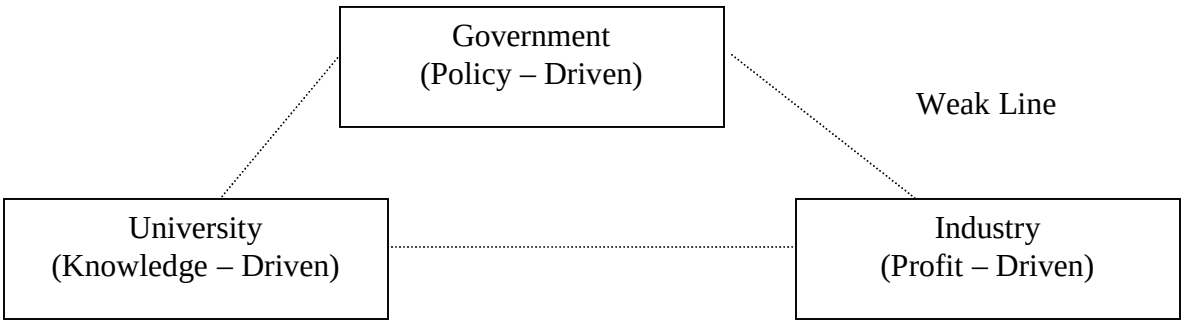


*Fig. 1: Government-University-Industry Interaction [7]*

Non effective linkage between the two sectors as observed in fig 1 are worsened by government inability to provide the necessary support.

## 5.0 APPROACH

The basic approach to this study is in examining the role of teaching methods, practical training on the quality of graduates in meeting standard requirement of most established engineering firms. Suggested learning methods – visual, sensory, inductive, active and global were used as a tool of assessing training methods in some selected institutions along with their various curricula [3]. Also the contributions of these graduates in some industries were evaluated. Most training programmes in Nigerian institutions are based on instinctive with emphasis on memories idea and insight while theoretical approach is a common feature. The listed learning styles were hardly in use. Most curriculums are not adequately structured to address class demonstration of principles and operations of systems. Most developing countries of the world such as Nigeria are

still grappling with the old methods of teaching practices of several years back which is predominantly theoretical.

## 6.0 OBSERVATIONS AND DISCUSSIONS

The study observed a very weak link between the school training programme, the curricula and the industrial activities. The curricula are not structured to meet the changing trend in engineering education especially in the areas of AUTOCAD, IT Skills and Systematic Model Design (SMD). The applied technologies in major multi-national companies in Nigeria lack strong local content and indigenous participation. The observed teaching methods have not succeeded in impacting positively on practical engineering training in schools. These training methods include traditional lecture delivery based on strong theoretical background, students industrial work experience scheme (SIWES). Necessary modifications of these methods are very imperative to meet the present industrial challenges [ 7]. Most of these multi-nationals in Nigeria source their fundamental and scientific research expertise and facilities from their home countries with little or no input from the local scientific research. The major institutions training facilities are obsolete and inadequate making practical training difficult to meet the modern trend. The industries in Nigeria do not have much stake in training, funding and curricula development of training institutions, which are the hallmark of industrialization in the developed world. There is no direct relationship and interaction between the industries and institutions in research activities and manufacturing. The identified poor elementary foundation in science subjects affects the students learning approach to engineering principles and applications. Studies have also shown the connection between learning approaches and workload [ 8]. The incessant violence in various campuses has been connected to so much idle time resulting into low quality of training since the workload do not reflect in-depth practical training. The practical class period on the timetable are spent on unfruitful exercise. Student learning becomes inefficient when the basic principles are not understood thereby leading to poor motivation .

## 7.0 THE WAY FORWARD

In building strong partnership between the tertiary/institution and industry towards engineering education transformation, the followings are suggested as way forward to adequately tackle the problem.

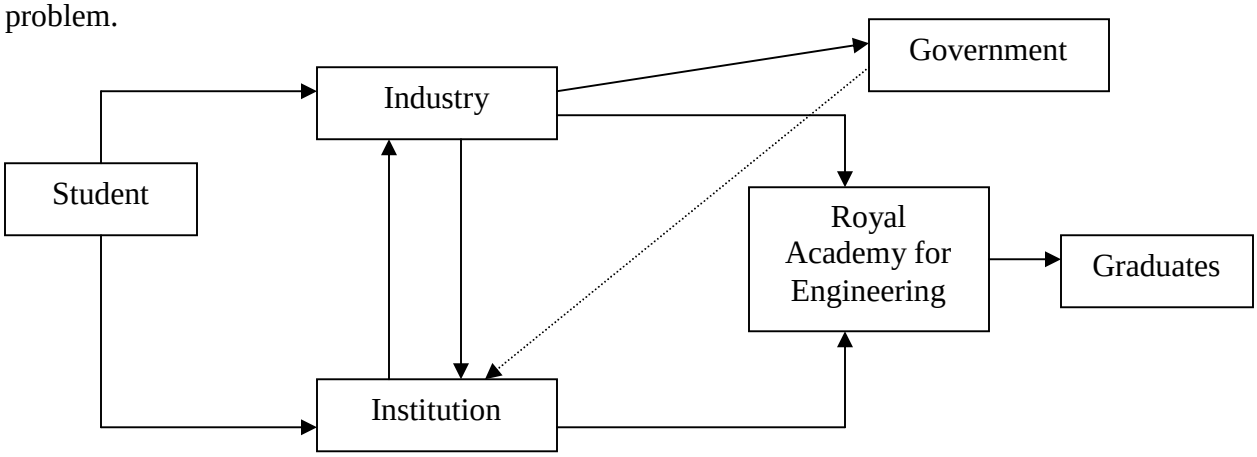


Fig. 2: Suggested Model in Government/Institution and Industry for Sustainable Engineering Education.

i. The model suggested in (fig 2) provides a platform of relationship where government role is only a facilitator. The model engage the enrolled student in engineering education to go through 5years programme between the institution and the industry and 1year internship at the Royal Academy for engineering before graduation as presented in table 3.

Table 3: Training Groups

| Class | Level | Curriculum | Location | Duration |
|---|---|---|---|---|
| 1. | 100 | Basic Engineering Principles | Institution | 1year |
| 2. | 200 | Practical Training | Industry | 1year |
| 3. | 300 | Core Engineering Principles and Applications | Institution | 1year |
| 4. | 400 | a) Core Engineering Principles and Applications Continued.<br>b) Engineering Project Studies.<br>c) Commencement of Students Projects | Institution<br><br>Industry | 6 months<br><br>6 months |
| 5. | 500 | a) Student Project Continued.<br>b) Core Specialized Subjects. | Industry/Institution | 1 year |
| 6. | Graduation Class | ▪ Internship Programme<br>▪ Entrepreneurship. | Royal Academy Institute | 1 year |

ii. Renaissance of talent based education from the elementary school.

iii. E-learning which consists of practical demonstrations, motion pictures, workshops, seminars, conferences and industrial visits.

iv. Curriculum review is an essential ingredient towards attainable sound engineering education. Courses such as technology in sustainable development, academic engineer as social engineer, cultural change in engineering education are suggested which is coordinated by hybrid lectures with the overall objectives provided [9].

- To develop consciousness among the students for the challenge that sustainable development poses to engineers.
- To develop students understanding of the role technology plays within the society at large, and more specifically in the process of sustainable development.
- To develop knowledge of the most relevant concepts, models and tools regarding sustainable development and basic skills for application during their professional life.

v. Integration of sustainable entrepreneurship. The development of personal skills connecting social aspects of technology, management and entrepreneurship are of increasing concern for engineers for in-depth engineering education [10]. Options adopted to evolve entrepreneurial and personal skills among engineering students include.

Training studies in micro-economy, business administration, marketing and financing. Integrating management and environment in the industry. Engaging students in management games. Encouraging students to prepare business plans for starting a company or developing new product design. These factors are major targets to produce entrepreneur engineer that will posses

the adequate knowledge of core engineering and demonstrable technical competence with intellectual foundation. This intellectual base will be applied in the conte xt of local environment towards industrialization.

## 8.0 ROLE OF GOVERNMENT

The role of government should be to facilitate research activities and funding of the institutions through the industry as presented in the developed model (fig 2). Government involvement in funding of the institution has hampered negatively since most of the fund are misappropriated and most cases grossly inadequate Government intervention in this direction has widened the gap between industry and institutions of learning. There is a need therefore for the government to redirect emphasis on being a facilitator rather than engage in direct investment which has not yield much required engineering educational transformation.

## 9.0 CONCLUSIONS AND RECOMMENDATIONS

Industry – institution partnership in training, research, curriculum development, funding and facilities upgrading is a major missing link in the quest for industrialization in developing economy like Nigeria. The present training methods as evaluated provides weak foundation, which cannot sustain industrial development. Most training programmes in major institutions are not in tune with modern facilities, which only the multi-nationals can afford. Most of these institutions are poorly funded. The interaction of institutions and in dustries in formulating programmes and curricula development will benefit the students, staff and companies. It will avails the companies the opportunity to evaluate the performance of young highly motivated graduates, which eventually serve as pool from w hich the companies can seek future full-time employees [11].

The following are subsequently recommended.

a) Industries should participate actively in the establishment of engineering workshops, laboratories for undergraduates to enhance quality training and research.
b) Industries/Academia cooperation in the areas of research and development with a view of establishing pilots projects, plants to enhance industrial experience of both teachers and students.
c) Regulatory and professional bodies such as Nigerian Soci ety of Engineers (NSE), Council for the Regulation of Engineering in Nigeria (COREN) should be engaged in the moderation, standardization of quality assurance of various industrial institutional collaboration for students, teachers and facilities.
d) Establishment of industrial-institution sabbaticals for both teachers and company's technocrats.

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