Engineering Technology Education in West African Countries: How Does it Compare With the ET Education in USA?

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Abstract

Until the late 1950's, engineering/engineering technology education in West Africa was shaped after the trade policies of the colonial powers ruling the region at that time. During the late 1950's and early 1960's, most of the West African countries such as Ghana, Nigeria, Sierra Leone, Ivory Coast, Senegal and the Gambia gained independence or self-rule and began to restructure engineering education. Most of these countries initially continued following the public education and training policies formulated by the old colonial regime. However, the demands imposed by the globalization of trade and commerce forced them to redesign their education and training strategies to effectively meet their economic development needs.

In the past, the engineering education in the West African countries was based on the needs of their agricultural sectors. Moreover, on one end of the occupational spectrum there was theory based engineering education and on the other end there was craftsmanship based vocational education. There was nothing in between. Engineering technology education was unknown or completely neglected. It was not until the 1990's when the importance of engineering technology education was recognized.

This paper begins with a description of the characteristics of engineering technology education in the United States. Then, the paper describes the evolution of engineering/engineering technology education in West African Countries. The engineering technology education trends in these countries are compared with those in the United States. Also, recommendations are made as to how US universities and colleges through technology transfer and distance education can work out international partnerships with educational institutions in West African Countries.

Engineering Technology Education in the United States

In the United States, the Accreditation Board for Engineering and Technology (ABET) specifies that engineering technology "…. lies in the occupational spectrum between the engineer and the craftsman at the end of the spectrum closest to the engineer." Engineering technology involves an understanding of technical skills as well as the various elements of mathematics, science and engineering. For over forty years, the engineering technology education in the United States has attempted to fill a void in the technical spectrum between skilled craftsman and engineer by providing application-based preparation for graduates who would use existing technology to solve problems in the areas of manufacturing, production, testing, construction, and applications engineering. Engineering technology programs at the educational institutions in the United States

normally range from two-year associate degree offerings at the technician level to four-year baccalaureate degree offerings producing engineering technologists. In addition, some of the educational institutions offer graduate programs in engineering technology. Engineering technology programs relate readily to industry. Through their emphasis on laboratory applications, engineering technology programs provide their students with a good understanding of industrial processes, materials, and equipment.

A large number of engineering technology programs are housed in engineering colleges or they are offered at educational institutions which also offer traditional engineering programs. This allows engineering technology faculty to develop collaboratives with engineering programs and faculty. To provide the appropriate education and training for their students, engineering technology faculty members are usually engineers or engineering technologists who typically possess adequate industrial experience.

Engineering technology programs usually have industrial advisory committees made up of the representatives from business and industry. Industrial advisory committees normally meet 2-3 times a year to review the specifics of engineering technology programs with the faculty members responsible for these programs. It is usually at these meeting that industrial advisory committee members and engineering technology faculty discuss plans for improvement in their programs.

In the United States, there are several organizations which assure strong representation of the core values of engineering technology. These organizations include Engineering Technology Council (ETC) of the American Society for Engineering Education (ASEE), Engineering Technology Division (ETD) of ASEE, and the Engineering Technology Leadership Institute (ETLI). These organizations and other engineering technology specific groups help to strengthen the values of the engineering technology community.

At present, in the United States, the goals and characteristics of engineering technology programs are not in conflict with those of traditional engineering programs [1] They are representatives of two major thrusts in engineering profession that are [2] :

1. Theory-based academic preparation for graduates who would choose careers focusing on research and development (both basic and applied) and conceptual design.

2. Applications-based academic preparation for graduates who would choose careers focusing on the application of existing technology to solve problems in manufacturing, production, and construction.

Detailed information regarding the various issues associated with engineering technology education in the United States may be found in [3] - [10].

Evolution of Engineering and Engineering Technology Education in West African Countries

Until the late 1940s engineering education in West African countries was developed mostly by intuition, where the need existed. Organizations like the telephone companies and the mining companies had their own schools. Most engineering graduates had to be educated outside the

countries of origin. This paper will cover the former British colonies of Gambia, Ghana, Sierra Leone and Nigeria.

Until the 1990s, engineering or technical training used to begin after six years of primary school. After primary school the option or selection was made by the educational authorities to determine who would continue to the middle school or who would go to trade school (vocational). The middle school track led to the possibility of secondary school and college track. Trade schools taught woodworking, automechanics, plumbing and electricity. Two years into middle school, a selection was made through competitive examinations to determine who would go for secondary school. After five years of secondary school, an individual would earn a Secondary School Certificate (Diploma). Just before the end of the fifth year, another selection process was conducted through competitive examinations to continue on the pre-college track. Only those who passed this examination could ever hope to pursue the college track and subsequently engineering education. However after secondary school and with a diploma one could enter the School of Mines or the Telecommunication School where the training was specified by the sponsoring institution.

After the 1950s, tertiary institutions called Polytechnics also sprung up because college track was limited to a few students only due to the selection process and one could earn a certificate in engineering technology through these institutions. A higher level of performance in these institutions could earn the student a place in an engineering school where he/she could obtain a Diploma in Engineering Technology (Associate Degree).

To earn a degree in engineering, one had to spend extra two years in the Secondary School to earn a Higher Secondary School Certificate to enter into college where engineering or engineering technology was taught. This process of pre-college preparation was in effect in all British West Africa until late 1950s when the independence movements in these countries brought some autonomy and eventual independence making it possible to take a fresh look at post-secondary and engineering education. Before this period, there was only one institution in West Africa where both the Nigerians and the Ghanaians could obtain engineering education and that was at Kumasi College of Technology.

In 1991, the Ghana Government through the Ghana Education Service decided to streamline the whole pre-college educational process. The old process of six year in primary school, then two year in middle school and seven years of secondary school education was considered too long and cumbersome. It was replaced by six years of primary education, three years of Junior Secondary School (JSS) and three more years of Secondary School (SS). After JSS a student can now enter a Technical Secondary School or the traditional Secondary School which leads to a college. The Technical Secondary School leads to the Polytechnics where engineering technology is taught at the level of community colleges in the United States.

Engineering Versus Engineering Technology in West African Countries

It can be argued that in most of these countries original design is not the main pre-occupation of engineers but that most job functions have to do with application installation and maintenance. Engineering technology should be the priority of engineering education. Until recently when these Polytechnics sprung up, there were more students in engineering than engineering technology. Most of the engineers after college found themselves in administrative positions

supervising technical people involved in installations application and maintenance. The emphasis on engineering technology is therefore the key to the development of the West African countries.

The Impact of Technological Advancement on Engineering Technology Education in West African Countries

The advancement of technology especially computer technology has widened the gap between these countries and the United States in engineering education. The main deficiency being the availability of up-to-date equipment and qualified teachers. In the 1990s when the Technical Secondary Schools were introduced, most schools could not afford even a drawing board and the computer aided drafting is just now being introduced. Personal computers and associated software are still too expensive for most institutions. However, a new approach dealing with the establishment of district science education centers is shaping up in Ghana. The concept is based on centralizing the available equipment in science at one location and transporting students to these centers to use the equipment according to a pre-arranged schedule. This arrangement enables the educational institutions to share resources both in equipment and manpower.

Distance education

With the advancement of the information highway, educational institutions in the United States and in West African countries have a wonderful opportunity to collaborate through technology transfer and preparation of course packages that could be utilized by these countries to solve their training needs and advance the engineering technology education. For example, lectures can be delivered using distance education technology and lab experiments can be conducted through computer simulation giving rise to global campuses at these sites.

Conclusion

This paper primarily dealt with the evolution and characteristics of engineering and engineering technology education in West African countries. The characteristics of engineering technology education in the United States were also described. Distance education was mentioned as an effective way for collaboration between the educational institutions in the United States and the West African countries. Such collaboratives will be valuable for fostering engineering and engineering technology education in West African countries.

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