Journal of Educational and Developmental Psychology; Vol. 9, No. 1; 2019
ISSN 1927-0526 E-ISSN 1927-0534
Published by Canadian Center of Science and Education

Cultivation of Polytechnic-Industry Linkage for Development and Delivery of Curriculum for Technical Education: A Case Study of The Federal Polytechnic, Ilaro

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Received: February 17, 2019 Accepted: April 15, 2019 Online Published: April 25, 2019

doi:10.5539/jedp.v9n1p69 URL: http://doi.org/10.5539/jedp.v9n1p69

Abstract

The implication of the unsuitability of young Nigerian graduates for available jobs in the industry raises the question as to the appropriateness of the training received while in school. It has exacerbated the unemployment problem in the Country, and it is worrisome. Of a necessity in curriculum development and delivery, therefore is the adoption of an approach that takes cognizance of the job function of the graduates in the industry and/or workplace and the skills required to perform on the job. In other words, the curriculum must target the job market demand and needs. This paper reports on the development of a demand-led curriculum in National Diploma Cement Engineering Technology through the partnership of the Federal Polytechnic, Ilaro with Cement Industry, Cement Training Institute of Nigeria, Manufacturers Association of Nigeria, and the National Board for Technical Education. The paper concludes that the emerging graduates from the implementation of the curriculum would have acquired the appropriate skills for the job, and would be acceptable and fit to perform effectively in the industry. Besides, opportunities for earning industry research income and reputation through the provision of research support to the industry is an added benefit derivable from the linkage.

Keywords: polytechnic, polytechnic-industry linkage, curriculum, technical education

1. Introduction

Nigeria's National Bureau of Statistics (2016) describes unemployment rate as a measure of the number of people actively looking for a job as a percentage of the labour force, and subsequently, puts the country's unemployment rate as 14.2% in 2016. In absolute term, estimated 11.549 million people were jobless. Persons most affected are the young (25.2%), the women (16.3%), and the rural dwellers (25.8%). This implies that about a quarter of the jobless people are the youths, and it is worrisome. Most of them are the young Nigerian graduates who are not employable because of their unsuitability for the available jobs.

The inappropriateness of the graduates for available jobs or mismatch of the output (graduates' skills) and skills required to do available jobs raises the question as to the adequacy of the curriculum in terms of skills it imparts on the graduates, and/or the relevance of the curriculum to the Industry. This phenomenon has been implicated as a major cause of the unemployment problem in Nigeria, Tanzania, Sierra Leone, Kenya, and elsewhere (Jibodu & Phiri, 1990; Matoka & Mwatelah, 2015; Duong, 2016). Direct linkage of available jobs with the training curriculum designed to teach proficiency in the skills required to perform in the job certainly would be an antidote to the imbalance in the curriculum and training needs of the Industry workers. On the challenges faced by unemployed engineers and technicians, Duong (2016) noted that in addition to looking for technical competence to do the job, the employers expected some "cognitive" and "social", or "behavioral", competences. They sought to see their ability to apply knowledge, skills, attitude, values and motivation in dealing with real-world problems. In addition, technical personnel are to have competences in problem-solving, creative thinking, teamwork, and critical thinking skills, for example. Consequently, there must be a shift in focus from knowledge-based to competency-based in the development and delivery of technician curriculum in order to make the graduates employable in the world of work. It is necessary, therefore, to review the approach hitherto adopted for the development and delivery of curriculum for technical education.

The advances in technological development that have led to the automation of industrial production systems further underscores the need to equip personnel, in this case, technicians, with necessary scientific and technical skills to cope with challenges of today and indeed of the future. Therefore, the adoption and deployment of an apt curriculum for technical education will rely more on the nature of the Industry production process. This, in turn, makes imperative a strong interaction between the TVET Institution and the Industry. Such interaction would reveal the job functions of the technical staff, and the skills and proficiency levels required to perform the job, and in the long run determine the content and structure of the TVET curriculum.

The cement industry in Nigeria is unable to employ the needed technical skilled manpower, particularly in the field of cement technology from the country's tertiary institutions. This is because none of the institutions offers cement technology as a course of study at either diploma or degree levels. Often times, they bring in expatriates from abroad with the associated problems of repatriation of foreign exchange. At best, the industry employs Nigerians who are skilled in related engineering fields and then given additional training abroad in cement technology before they could really fit into the job. Furthermore, junior staff cadres in the industry were established through training of the primary and secondary school graduates on specific artisans' skills in the company's training schools. The core technical manpower both at the senior and middle levels is not available in the country, yet the cement industry is one of the fastest growing manufacturing sectors of the economy.

To reverse the trend, therefore it is necessary to develop appropriate curricula for technicians' training in cement technology for the Industry in the country. Consequently, the Governing Council of the Federal Polytechnic, Ilaro sought to address this problem more so that four major cement works owned by LAFARGE (WAPCO) Cement Plc and DANGOTE Cement Plc are located in the vicinity of the Polytechnic. Also, the institution has an on-going agreement for training the technical staff of LAFARGE (WAPCO) Cement Plc. on specific performance improvement skills. The Council intended to work in collaboration with the Cement Industry and the National Board for Technical Education to develop appropriate Curricula for the training of technicians in cement technology. In addition, a Department of Cement Technology for teaching and research in the field of study would be established in the Polytechnic.

This paper, therefore reports the case study of the development of a curriculum for National Diploma programme in Cement Engineering Technology by the Federal Polytechnic, Ilaro through Polytechnic-Industry linkage.

2. Polytechnic-Industry Linkage and the Concept of Curriculum Development for Technical Education

The development of curriculum for any academic programme for that matter to be mounted in any institution usually has always been based on either of the following procedures:

a. Adoption with or without modification of curriculum in use in an established similar institution;

b. Collation of ideas from a group of teaching staff believed to have long-standing teaching experience in the field of teaching/specialization; or

c. Results of a survey conducted to study the job functions and the scientific and technical skills required of the graduates to be produced from the training programme (Jibodu and Phiri, 1990).

While the last procedure of curriculum development appears to be the best because it is dynamic and responsive to challenges in employment, the earlier methods are static and bureaucratic in nature and may have limited relevance in the latest scientific techniques and skills required to perform in today's world of computerization and automation of production systems. Indeed, Boahin and Hofman (2013) noticed an emergence of a remarkable correlation between academic disciplines and industry training on the acquisition of appropriate skills for employability. The authors concluded that adequate training scheme or curriculum should take cognizance of the specific skills required to perform at the workplace. Also, Jibodu and Phiri (1990) asserted that for graduates of technical institutions to acquire the needed skills and attitudes relevant to job situations, the employers should be closely involved in the process of curriculum development with the participation of policy makers and the training institutions.

Unfortunately, curricula in use for the delivery of technical education in Polytechnics in Nigeria were evolved by NBTE through the collation of ideas from groups of teaching staff believed to have long-standing teaching experience in the field of specialization of interest, and accreditation of the programmes is tied to the operation of such curricula. It is necessary therefore that the curriculum currently in use should be evaluated and possibly revalidated in the light of providing better learning opportunities and production of quality graduates with the right skills to perform in the workplace.

Fortunately too, the Polytechnics are at the liberty to improve on the curriculum by the NBTE's declaration that the curriculum is a 'minimum guide'. Also, NBTE in the 'Guidance Notes for Teachers Teaching the Programme' observed that the success of the curriculum depends on the articulation of programmes between the institution and the industry. Hence it encourages the teaching staff in the training institutions, under which the performance can take place, to make additions to the curriculum depending on the needs of the local environment and follow that with the criteria for determining an acceptable level of performance.

Adoption of curriculum based on job functions of technicians will require that there is a corresponding staff development effort, which enables staff to cope with these new challenges. More so, that the emerging curricula will be dynamic because the job functions of the technical staff will undergo constant change as new technology emerges in the workplace. It is imperative therefore that the polytechnic providing technical education should put in place staff appraisal, which encourages staff to identify their own strengths and weaknesses and enables development opportunities to occur which enhance their performance. Also, capacity development opportunities should embrace attachment for teaching staff to the industry for work experience. On return from attachment, the teachers will bring their experience to bear on the delivery of the curricula (Jibodu and Oloyo, 1998).

In contemporary time, the development and adoption of technical education curriculum that allows measurement of competence in skills acquired are becoming louder in most emerging economies of the world (Boahin, Eggink, & Hofman, 2013). In this case, training is based on performance and standards and is related to realistic workplace practices. It focuses on what learners can do rather than on the courses they have done (Misko, 1999). Consequently, competency levels achieved in the acquired skills are graded and certified as a proficiency qualification. This approach of curriculum development, to some extent, has a semblance with that method of curriculum developed based on the job functions of the technicians in that both methods train students to achieve proficiency in the skills required to perform their job in the industry. Also, because the Industry input is required in the development and delivery of curricula emerging through both methods, a very strong tie between the TVET institution and the Industry becomes imperative. Indeed, Micheni and Awour (2015) submitted that a strong linkage between the TVET institutions and the industry is vital for the institutions to remain relevant to the enterprises and job seekers. The authors, therefore, asserted that a well-coordinated TVET institutions-Industry partnership capable of supporting work integrated learning programmes would impart relevant practical skills for direct absorption of the students in the industry. That is, the transition of trainees from school to the workplace would be smooth and easily accomplished.

3. Current Position of Polytechnic-Industry linkage in the Development and Delivery of the Technical Education Curriculum in Nigeria

The importance of the polytechnic-industry linkage in the delivery of the curriculum for the training of technical personnel cannot be overemphasized. This perhaps is the reason for the inclusion of the representative of the Manufacturers Association of Nigeria in the composition of the Governing Council of the Polytechnic (Decree No. 33, 1979). Also, while performing the supervisory role on the general wellbeing of the technician's curriculum, the National Board for Technical Education includes representatives from the industrial sector of the economy in the team of programme accreditation. Besides, the Board permits the appointment of a senior worker in the industry as one of the two External Examiners scheduled for an academic programme. Furthermore, conditions of the award of Diploma are based on successful completion of four months Student Industrial Work Experience (SIWES) sandwiched between two semesters, among others.

In an appraisal of the adequacy or otherwise of the delivery of the academic content of the NBTE's curriculum for technicians in science technology, Jibodu and Oloyo (1998) noted that although the curriculum recognizes the importance of SIWES component in the overall training of a technician, there is no link whatsoever with the academic content at the development stage of the curriculum. Furthermore, there is a divergence of experiences acquired by trainees because they were attached to different industrial places. Only the teaching staff that undertook industrial attachment can bring to bear his experience in his teaching and development of curriculum. Unfortunately, the curriculum did not make provision for Industrial Work Experience for the teaching staff.

Oloyo (2015) described the relationship that exists between the polytechnics and the industry as a mere partial involvement in the development and monitoring of the curriculum. The industry absorbs the students for Industrial Work Experience Scheme, only. The institutions have not responded well enough to the research and development needs of the industry. More so, that the polytechnics are performing below expectation in the field of research and development. Also, not much has been recorded in the area of copy technology and innovation.

The need to change the trend if the polytechnic would do well in the World Rankings of tertiary institutions is imperative. The managers of the polytechnics must make concerted efforts first, to identify major industries within their catchment areas with their research and development needs; and second, seek collaboration with the industry for research and development solution. This will boost the polytechnic's ability to help industry with innovations, inventions, and consultancy as a measure of knowledge transfer. In addition, the Polytechnic will earn Industry income or research income.

4. Development of Curriculum for National Diploma Cement Engineering Technology Through Polytechnic-Industry Linkage – A case study of The Federal Polytechnic, Ilaro, Nigeria

4.1 Establishment, Geographical Location, Organisational Structure of the Federal Polytechnic, Ilaro, and Its Relationship with the National Board for Technical Education

Establishment

Decree No. 33 of July 25, 1979 (now The Federal Polytechnics Act, 1990) established the Polytechnic to perform the following functions:

i. Provide full-time courses in technology, applied science, commerce, management, and in other fields of applied learning relevant to the needs of the development of Nigeria;

ii. Arrange conferences, seminars, and study groups relating to the fields of learning specified in paragraph (i) above; and

iii. Perform such other functions as in the opinion of the Council may serve to promote the objectives of the Polytechnic.

Geographical Location

The polytechnic occupies an 898.116 hectares land area. It is situated within the geographic zone of GWS 32 bounded by coordinates 496000Em, 769000Nm and 500000Em, 7660067Nm. Its shape is a skewed rectangle of about 8857946Km^2 and perimeter of about 12085.17m. It is bounded to the south by the Ilaro/Oja-odan road leading to the Republic of Benin. The Polytechnic is located about 3Km from Ilaro town and 60Km from the Nigeria/Republic of Benin border. The host town is landlocked between Lagos and Abeokuta, capital cities of Lagos State and Ogun State, respectively. It is located at 6.88901 (latitude in decimal degrees), 3.01416 (longitude in decimal degrees) at an average elevation of 90m above mean sea level (MSL). The geographical landscape comprises extensive fertile soil for agriculture and savannah land in the northwestern part suitable for cattle rearing. Also, there are mineral deposits mostly phosphate and limestone. Indeed, the town is located on the limestone belt of the State. Consequently, the most leading cement manufacturing industries in Nigeria are located in the region (Babalola et al., 2016).

Academic Programmes

The Polytechnic runs fifty-five (55) NBTE-accredited technology-based and management-based National Diploma programmes at the Ordinary and the Higher levels. It offers the academic programmes from six (6) Schools namely, Engineering, Environmental Studies, Information & Communication, Management Studies, Pure & Applied Science, and Part-time Studies. Departments running related courses are grouped together and managed in a School under the leadership of the Dean.

Administrative and Organizational Structure

The Governing Council sits at the top of the overall administration and management of the Polytechnic, and it is vested with the authority of supervision, and finances of the institution. Next in line is the Academic Board, a committee that regulates and manages academic affairs including students' admission, and award of scholarships, diploma, fellowships, and other academic distinctions. The Academic Board is a committee of the Rector, the Librarian, all Heads of Departments, all Chief Lecturers, and the representative of the teaching staff who are not Heads of Departments. Meanwhile, the committee of Principal Officers led by the Rector constitutes Polytechnic Management, and it manages matters other than academic.

Together with the six main academic Schools, thirteen academic support and service units are the components of the Polytechnic and are integrated into its organizational structure. All Heads of components are directly responsible to the Rector for routine administration of the institution. The academic support units are the Library, Academic & Physical Planning Unit, Centre for Research & Development, Directorate of Linkage & Affiliation,

Entrepreneurship Developmental Centre, World Bank STEP-B Project Centre, Directorate of Student Affairs, and Polytechnic Consultancy & Industrial Services. Registry (Central Administration), Bursary, Internal Audit, Works & Service Department, and Medical Centre make up the service units.

The relationship between the Federal Polytechnic, Ilaro and the National Board for Technical Education

The National Board for Technical Education is connected with the administration and management of the Federal Polytechnic as stipulated in the NBTE Decree No. 9 of 1977. The Decree conferred in NBTE the authority to determine the skilled and middle-level manpower needs of the country in the industrial, commercial, and other relevant fields. Furthermore, it would plan training facilities and prepare periodic master plans for the balanced and coordinated development of polytechnics and colleges of technology in the country. The plans would include, among others:

i. Specify and approved academic programmes to be offered by the institutions while taking cognizance of manpower needs of the country, available facilities, and avoiding duplication of courses.

ii. Determine the financial requirements of the technical institutions and advise the Federal Government (the proprietor) on same as appropriate.

iii. Specify and harmonize entry requirements and duration of courses offered by the institutions.

iv. To set standards of skill to be attained and to continually review such standards as necessitated by technological and national needs.

4.2 Historical Working Relationship with a Foremost Cement Industry, LAFARGE Cement WAPCO Nigeria (formerly, West African Portland Cement Company Plc.)

The Federal Polytechnic, Ilaro has a history of working relationship with the Human Resource Department of LAFARGE Cement WAPCO Nigeria on capacity development of the factory workers. The history dated back to 1996 when the former was commissioned to train the junior factory workers on performance improvement in their jobs. Thereafter, other training programmes targeted Factory Operatives, Supervisors, and Graduate Trainees (i.e. Middle-level Management Staff). Large numbers of LARFAG staff were trained in tranches of six-month duration, and all the training programmes were residential programmes on the Polytechnic campus.

The latest of the training programmes were designed to address the challenges inhibiting the productive capacity of the Company. Specifically, the curriculum addressed technical deficiencies of operatives in the key areas of the Company's operations identified by their immediate supervisors or heads of Sections. On returning from the training, the beneficiaries' performances on the job were evaluated by industry-based supervisors. The feedback received from the evaluation exercises revealed that the trained staff were abreast of current and best practices in their various work areas, communicate better, more skilful, were self-reliant, and highly productive. Above all, the Company declared that the partnership programme saved the Company capital flight in terms of foreign exchange hitherto expended on overseas training in the time past. In other words, it was economical and efficient to train staff locally under the partnership with the Polytechnic. On the other hand, the linkage programme earned the Polytechnic partnership reputation and internally generated revenue income.

4.3 Development of the ND Cement Engineering Technology Curriculum

The procedure followed for the development of the curriculum is highlighted in Table 1. Also, the procedure is summarized and depicted in Figure 1.

Table 1. Summary of the procedure adopted for the development of the ND Cement Engineering Technology Curriculum

Stage	Activity
Step 1	• Establishing the need and/or market demand for Cement Engineering Technology Diplomates. • Ascertaining that the programme, if developed and offered by the Polytechnic, does not run contrary to the Institution's mandate.
Step 2	• Establishing linkage with the Cement Industry and Cement Training Institute of Nigeria through the Manufacturers Association of Nigeria for commitment to participate in and finance the Development of the Curriculum. • Seeking involvement of the National Board for Technical Education by approving and leading the Curriculum development.
Step 3	• Identification and selection of a team of experts from the Polytechnic's faculty to participate in the development of the curriculum. Experts were drawn from Colleges of Engineering, Environmental Studies, and Applied Science. • Coordinated by the Manufacturers Association of Nigeria, the Cement Industry assembles a team comprising technical staff from leading cement industries in the country (i.e. LAFARGE WAPCO Cement Plc., DANGOTE Cement, Plc., Ashaka Cement Plc., and Purechem Industries Ltd) and Cement Training Institute of Nigeria to participate in the development of the curriculum. • NBTE's team had as its leader the Director of Programmes and Programme Officers in Engineering, Environmental Science, and Applied Science fields as members.
Step 4	• The Polytechnic's team conducted a study tour of the quarry and the cement works of LAFARGE WAPCO Cement Plc. with a view of collating information on the major operations of the industrial process beginning from the mining of cement raw material, through cement production, and up to packaging of finished product. Also, the team studied activities at the quality and process control laboratories.
Step 5	• Preparation of a draft curriculum, by the Polytechnic team, to be used as the starter (working paper) for subsequent critique summits of all the partners.
Step 6	• First Critique Summit on the development of the curriculum worked on the draft curriculum presented by the Polytechnic's team. A second draft curriculum emerged from the exercise.
Step 7	• Second Critique Summit worked on the outcome of the earlier summit (i.e. second draft curriculum). The summit ensured that the second draft curriculum complied with all NBTE standards, and by implication, national standards as enshrined in the National Policy on Education. The third draft curriculum emerged.
Step 8	• National Workshop, a wider Summit with more members from other stakeholders including the Council of Registered Engineers of Nigeria and other Cement Production Companies outside the Western Nigeria, which hitherto was not represented at the first two critique summits, critiqued the third draft curriculum. • The final draft curriculum emerged from the National Summit.
Step 9	• Recommendation and presentation of the final draft curriculum for the consideration and approval of the Governing Board of the National Board for Technical Education.
Step 10	• NBTE-approved Curriculum for ND Cement Engineering Technology is ready for implementation.

Figure 1. Procedure adopted for the development of the curriculum

5. Conclusion

It may be concluded, from the foregoing, that the limited interaction between the polytechnic and the industry had limited the impact of technical education on the general wellbeing of the industry. Indeed, the interaction had been limited to mere engagement of polytechnic students on short industrial attachment, only. However, the industry could play a more beneficial role in the development and delivery of curriculum for technical education, absorbing the students after graduation, and boosting the internally generated revenue of the institution through engagement of the Polytechnic faculty in research. Unfortunately, mass unemployment of Nigerian graduates is only noticeable because of the perceived unsuitability of the graduate for the available job. Curriculum developed through joint participation of the polytechnic and the industry seems to be the remedy. Graduates emerging from the implementation of the curriculum developed through such partnership would have acquired the appropriate skills for the job and would be acceptable and fit to perform effectively in the industry. Besides, opportunities for earning

industry research income and reputation through the provision of research support to the industry is an added benefit derivable from the linkage.

References

Babalola F. A., Ajose-Ismail, M. A., Awolesi, J. A., Kolawole, A. O., Aikulola, O. A., Oyesile, S. O., … & Osore, A. F. (2016). *The Federal Polytechnic, Ilaro, Master Plan Report (2015-2030)*. Ogun State, Nigeria: Federal Polytechnic, Ilaro.

Boahin, P., & Hofman, A. (2013) A disciplinary perspective of competency-based training on the acquisition of employability skills. *Journal of Vocational Education & Training, 65*(3), 385-401. https://doi.org/10.1080/13636820.2013.834954

Boahin, P., Eggink, J., & Hofman, A. (2013). Competency-based training in international perspective: comparing the implementation processes towards the achievement of employability. *Journal of Curriculum Studies, 46*(6) 839-858. https://doi.org/10.1080/00220272.2013.812680

Duong, T. K. O. (2016). *Developing core competencies of students through Competence Based Assessment at Ho Chi Minh City University of Technology and Education*. In: TVET@Asia, issue 7, 1-17. Retreived from http://www.tvet-online.asia/issue7/duong_tvet7.pdf

Federal Polytechnic Act. Cap 139, Laws of The Federation of Nigeria. (1990).

Jibodu, K. O., & Phiri, A. G. (1990) Updating polytechnic curriculum to suit work functions in employment. *A Journal of Technical Education & Training*, 26-32.

Jiboku, K. O., & Oloyo, R. A. (1998). An appraisal of the delivery of academic content of curriculum for technicians in pure and applied sciences. *Proceedings of 1st National Seminar on 'Managing Resources for Effective Technology Manpower Training in Pure and Applied Science' held at: The Polytechnic*, Ibadan, August 12-14, 1998; Federal Polytechnic, Bauchi, August 19-21, 1998; Federal Polytechnic, Nekede Owerri, September 23-25; and Kaduna Polytechnic, Kaduna, October 7-9, 1998 organized by the National Board for Technical Education, Kaduna, 19-27.

Matoka, C. M., & Mwatelah, J. K. Z. (2015). Review Paper: Public Private Partnership for Sustainable Economic Growth and Employment Creation in Oil and Gas Sector. *CAPA Scientific Journal, 3*(1), 78-86.

Micheni, E., & Awour, C. T. (2015). Review Paper: An Assessment of the Partnerships between TVET Institutions and Industry in Kenya. *CAPA Scientific Journal, 3*(1), 96-105.

Misko, J. (1999). *Competency-based Training, Leabrook, National Centre for Vocational Education Research* (NCVER).

National Board for Technical Education Decree No. 9. (1977).

National Bureau of Statistics. (2016). *Q4 2016 Unemployment Report*. National Bureau of Statistics, Abuja, Nigeria. www.nigerianstat.gov.ng

Oloyo, R. A. (2015). Repositioning Nigerian polytechnic system for academic excellence. *The 9th Convocation lecture of the Federal Polytechnic,* Ede delivered on November 18, 2015.

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