Building a Bridge Between Gown and Town Through Infusion of Industrial Experience Into Students' Final Year Project

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Abstract

Education, the imparting and acquiring of knowledge through teaching and learning has many parts; it is the knowledge or ability gained through training. Education may mean learning or informative experience gained through learning among others. Education may be formal or methodically structured on one hand, or informal in nature on the other. Formal education is acquired in stages and it is fashioned after perceived intelligence quotient expected of developmental stages of mankind usually from the Nursery School to a degree awarding Educational Institution. At the apex of education is the Students' Industrial Work Experience Scheme (SIWES) designed to acquaint students with the industry while still undergoing academic training with the sole aim of preparing them for industrial challenges of the futurity. Moreover, every programme at the apex educational institution terminates with student project culminating in a dissertation. This paper considers the positions of SIWES and the students' Final Project and proposes an infusion of the two important components of our educational curriculum with the ultimate aim of turning out well groomed professionals that are capable of successfully driving our economy through Vision 20:2020.

Keywords: *industrial experience; students' project; infusion; educational curriculum; vision20:2020.*

Introduction

The growing concern among our industrialists that graduates of our institutions of higher learning lack adequate practical background studies preparatory for employment in industries, led to the formation of students Industrial Work Experience Scheme (SIWES) by ITF in 1993/1994 (Information and Guideline for SIWES, 2002). One of the key functions of ITF is to work as cooperative entity with industry and commerce where students in institutions of higher learning can undertake mid-career work experience attachment in industries which are compatible with student's area of study (Okorie 2002, Asikadi 2003).

In the study carried out by Wodi and Dokubo (2009), it was reiterated that the problem of skill acquisition by graduates of Nigerian Technical/Vocational Education is a reason for the establishment of SIWES. The scheme was planned to serve as a bridge between educational institutions and industrial employers with the latter providing general and specific occupational skills and knowledge. Specifically, the objectives of the Students Industrial Work Experience Scheme (SIWES) are to:

- Provide an avenue for students in institutions of higher learning to acquire industrial skills and experience in their course of study, which are restricted to Engineering and Technology including Environmental studies and other courses that may be approved. Courses of NCE (Technical), NCE Agriculture, NCE (Business), NCE (Fine and Applied Arts) and NCE (Home Economics) in Colleges of Education are also included.

- Prepare students for the industrial work situation they are to meet after graduation;
- Expose students to work methods and techniques in handling equipment and machinery that may not be available in their institutions.
- Make the transition from school to the world of work easier, and enhance students contacts for later job placement;
- Provide students with an opportunity to apply their knowledge in real work situation thereby bridging the gap between theory and practice; and
- Enlist and strengthen employers, involvement in the entire educational process and prepare students for employment in Industry and Commerce.

According to Mafe (2010), for the participation of Nigerian students in trans-national exchange programme for industrial experience to enhance the attainment of the goals of the scheme, there is need for a clear understanding and appreciation of the distinction between "work-experience" and "work-integrated learning" or "cooperative education. In his own words; work-experience is observational and exploratory whereby students are exposed to the production process with limited monitoring of the students' performance and assessment of the performance after completion of the programme. On the other hand, the focus of work-integrated learning is the development of the occupational competency of the student with the main purpose being learning. Already, SIWES has many aspects of cooperative education incorporated into its structure and operation (e.g. planning, placement, supervision and assessment) but is deficient in implementation. It is, therefore, important that concerted efforts be adopted by all SIWES stakeholders to ensure that SIWES meets its objectives.

On the other hand, the students' final year project provides the mechanism that enables the students' examiners to assess the suitability of the students undergoing training under their tutelage to face the challenges of the industry. The final year report is an important undertaking that represent the documentation of all the activities involved in successful implementation of the project and should use the structural guidelines outlined approved for that purpose. Examiners are very interested in the process that was used during the final year project. The mechanism for detailing the process is the final year project report.

Objectives of the Study

A way of achieving work-integrated learning that must necessarily be targeted at the meaningful development of truly employable professionals is to incorporate internship into their course curricula. However, SIWES as a programme has a fundamental setback; most industrial concerns are very reluctant to absorb students into the obligatory internship in their organizations due to the following reasons:

1. The period of internship is too short for the students to undergo a short training where the task to be performed requires specialized skills for the company to benefit from their investment on the intern, and
2. The interns may, in most cases, not add any value to their employers product(s) in terms of research and development.

The students' final project, although a course in partial fulfillment of requirements for the award of a degree, is also a harmonization of all knowledge acquired by the students during the course of study which prepare the student for the task of managing any project from the conceptualizing stage to the close of the project. It exposes the future professional to the methodology that enables him/her to bring to bear all the skills acquired during the course of learning and the personal prowess developed overtime on his/her future endeavours culminating in

successful execution of any task to a profitable completion. The aim of this paper is therefore to find the meeting point between the two courses namely SIWES and the student final project and suggest a way of harmonizing the two schemes for the betterment of our educational products. The objectives of the study are therefore summarized as follows:

1. To promote a better understanding of the student final project and the students industrial work experience scheme (SIWES)
2. To seek to improve the quality of the products of Nigerian universities through proper implementation of students' final project and SIWES.
3. To harmonize the aims and purpose of students' final year project and SIWES for the purpose of preparing Nigerian graduates for post qualification challenges.

The Students' Industrial Work Experience Scheme (SIWES)

The issues considered in this study shall be based on literature and personal experience as the departmental SIWES coordinator at the Department of Systems Engineering, University of Lagos in Nigeria and a university lecturer whose experience as a students' final year project supervisor spanned a period of seventeen years. According to Oyeniyi (2011), students' Industrial Work Experience Scheme (SIWES) is a programme designed to expose and prepare students of Institutions of Higher Learning for industrial work situation which they are likely to meet after graduation. It is a skill acquisition/training programme which affords students the opportunity of familiarizing and exposing themselves to the needed experience in handling industrial equipment and machinery that are not usually available in their institutions. The establishment of the scheme was to alleviate the fear of industrialists that products of institutions of higher learning in Nigeria are inadequately prepared for the world of work. Based on these facts, the scheme was established to achieve certain objectives such as to:

- provide an avenue for students in institutions of higher learning to acquire industrial skills and experience in their course of study, which are restricted to engineering and technology including environmental studies and other courses that may be approved;
- Expose students to basic methods and techniques in handling equipment and machinery that may not be available in their learning institutions;
- make the transition from school to the world of work easier, and enhance students contacts for late job placement; and
- strengthen employers, involvement in the entire educational process and prepare students for employment in industry and commerce (Industry Training Fund, 2002; 1-3).

The Students' Final Year Project (SFYP)

In the contribution made by Letherland Caroline lead Curriculum Enhancement project, the Students' Final Year Project (SFYP) is defined as research-based learning which includes preparing all students to undertake an autonomous piece of research work as the culmination of their degree programme. SFYP is seen by students as the pinnacle of their academic achievement, not only because of the academic rigour that is imposed on it by the University, but also because of the control they have to design, carry out and evaluate what they do. It is often seen to represent the point at which students become truly members of a disciplinary group. It is a universal norm that this piece of work must possess the following characteristics:

1. It must be compulsory
2. It must have significant number of credits allocated to it

3. It must be assessed in a way which relates to it being a research based activity
4. It must be supervised within the school (although there may be occasions where co-supervision is the best way forward, where this can be negotiated)
5. It must result in an individual report responding to a question negotiated at the level of the individual student (which may fit together into a piece of work which a group could do)
6. It must be undertaken according to a research method defined by the student in their report

And in relation to assessment, the importance of this piece of work in terms of credit weighting and therefore potential influence on the degree classification requires that it should be double blind marked. A model that is similar to our proposal in the Department of Systems Engineering, University of Lagos, Nigeria is the one practiced at the Department of industrial and Systems Engineering, University of Pretoria, South Africa.

The Department of Industrial and Systems Engineering SFYP Experience

As part of the pre-requisites for the bachelor's degree in Industrial Engineering, students in their final year of study are required to complete an engineering project in which fundamental industrial engineering knowledge and skills are applied. The project, executed over two semesters from February to October, forms an essential part of the training and industry exposure of Industrial Engineering students at the University of Pretoria (UP). The total project carries a total of 40 credits or 400 learning hours, equivalent to approximately 2.5 months of full-time work. The project consists of the following four sequential phases, namely:

Phase I: Project planning

- Background
- Problem Statement
- Project Aim & Key Deliverables
- Project Approach

Phase II: Literature review & environmental analysis

- Critical analysis of literature and environment
- Data information and data gathering
- Identification of design/problem solving concept and approach

Phase III: Detailed design and/or problem solving

Phase IV: Completion and presentation of results and final report

However, the students have the freedom to define their own project topic, but it is expected that most projects will originate from industry and be initiated by a definition of the project by an industry sponsor. Industry support is essential in order to identify suitable projects. Students have the responsibility to choose an appropriate environment where they are required to complete an engineering project in which fundamental industrial engineering knowledge and skills are applied. The outcomes of this project are assessed using an assessment sheet. In order to complete their project successfully they have to identify and solve an engineering problem. As part of their final year project students are required to:

- Analyse existing literature that can assist in design and/or problem solving.
- Identify available industrial engineering methods, tools and/or techniques that can be used in design and/or problem solving.
- Select the most appropriate method(s), tool(s) and/or technique(s) for design/problem solving.
- Develop supplementary methods, tools and or techniques that can assist them with a design/solution

- Apply appropriate engineering methods, skills and tools in the problem solving approach.
- Test and validate all the results

Also, students are required to:

- Clearly define an existing design and/or problem
- Design a solution approach to solve the identified problem.

In addition to the aforementioned, they are to carry out investigations, experiments and data analysis

As part of their final year project students are required to analyse a project environment and gather/document all information and data to be used in development of a design/solution to the identified problem.

The aim of the Project Definition is to briefly describe the background and rationale for the project, the high level project objectives and expected key deliverables and initial scoping of the project in terms of the field of study and boundaries of the investigation and solution. A project will typically involve the analysis, improvement, optimisation or design of a defined business process, operation, complex system or a component thereof. Important criteria for the evaluation of the suitability of a project are:

1. Clarity on the expected benefit or value add of the project
2. The application of industrial engineering principles, tools and techniques
3. Clear evidence of engineering analysis and design, that is an improved or new approach, model, process, facility or system needs to be developed or formulated. In exceptional cases the project might be purely investigative in nature, but the complexity and value add needs to be clear.

The Project Definition should provide sufficient details to allow a student to select the project based on his/her areas of interest (if defined by an industry sponsor) and to allow the course coordinator to make a judgement on the suitability of the project and to allocate a project leader with the necessary expertise. As a guideline, the following key aspects should ideally be covered in no more than a one page Project Definition:

1. Brief background on the company, environment and project
2. Rationale for the project in terms of expected benefit and building on previous work
3. Project scope, defining the area or department within which the project will be executed and solution developed
4. Key policies or constraints that might apply to the project solution development
5. Expected key deliverables of the project (if possible)
6. Tools and techniques that can be used (if possible)
7. A suggested high level outline of the approach that can be followed (if possible).

The project definition will provide the basis for the student to develop a project proposal, including background, problem statement or needs requirement, project aim and specific objectives, project approach, resources required, deliverables, and timelines. Students are expected to gain a full understanding of the problem and research and investigate alternative approaches to develop a solution in the project proposal. To facilitate easy implementation of the project, a project sponsor is required.

A project sponsor is the key contact within the company who should be able to provide the best guidance on the project and is most likely to gain from the success of the project. The project sponsor has the following important responsibilities:

1. Confirm his/her role as project sponsor, duly authorized by the company. Multiple sponsors can be appointed, but is not advised.

2. Review and approve the Project Proposal, ensuring that it clearly defines the problem to be investigated by the student and that the project aim, scope, deliverables and approach is acceptable.
3. Review and approve the Project Report, ensuring that information is accurate and the solution addresses the problems and/or design requirements of the defined project.
4. Ensure that sensitive of confidential information or intellectual property of the company is not disclosed in the document.
5. Acknowledges the intended publication of the document on UP Space. A Project Sponsor Form is available to obtain sign-off from their Project Sponsors.
6. Intellectual Property Ownership of Project Reports. The University of Pretoria has Intellectual Ownership of the project documents delivered by the student. Project reports from previous years have been published electronically on UP Space. It is the student's responsibility to liaise with the industry sponsor to establish whether the final project report may be published. If not, the following is suggested to protect company sensitive or confidential information:
    - Make use of a fictitious name representing the Company, e.g. ABC, XYZ, etc.
    - Withhold, exclude or adjust important confidential or sensitive data, such as design drawings or financial information.

The Practice at the Department of Systems Engineering, University of Lagos, Nigeria

Established in year 2000, the pioneering Department of Systems Engineering in Nigeria has evolved into a dynamic and viable entity that champions radical changes both within the University of Lagos and in the larger Nigeria. Until two years ago, allocation of supervisors to students on both the SIWES and the SFYP has been done in the reactive manner adopted by any other department in the university. However, since two sessions ago, allocation of project supervisors to students is done after the first semester of the 400level of the 5 year degree programme to enable students academic supervisors interact with the students so that anytime opportunity arises in the industry to solve industry based problems the students may invite their project supervisors to interact with the industry based supervisor(s) with the aim of defining a researchable problem which the students could take up as their final project(s). Students in the department are involved with grouped projects in order that they may develop the spirit of team-work even while they are still in school.
The model adopted by the department is closely related to that of the department of industrial and systems engineering in the South Africa in that asides the number of hours and the weight assigned to SFYP and the financial backing received from the industries, which eventually is the target of our model, the department work within the framework provided by the laws that established the University of Lagos to open up new research areas in the industries. The conception of the students' final year project involves:

1. A brief of the students by each academic supervisors.
2. Establishment of communication network between the project group members and their supervisor for updates on the progress made so far in identifying an industry based problem that is worth the while.
3. The interns are instructed to be explicit about their quest to identify, clearly define and address an industry based problem that if not completely solved while serving in the company could transform into a final year project.

4. The academic supervisors, on a visit to the company, are required to specifically enquire from the industry based supervisors if there exist such practical problem peculiar to their companies that may challenge the candidates' intellectual capabilities.

The direct implication of the aforementioned is that:

1. The students would stimulate intrinsic interest in the activities of the company where they work as intern.
2. The students build the kind of confidence they require to confront their future endeavours.
3. The environment to work is readily available since students could revert to the company as the situations demand especially when they need specialized equipment.
4. The financial resources required to bring the project to fruition is readily provided by the company.
5. The company also gains by way of tax reduction.
6. The industries also build symbiotic relationship between themselves and the department thereby creating opportunity for potential interns from the department and consequently good job opportunity for the products of the department.
7. The country benefits from the model both at the nonce and in the futurity.

to mention but a few.

Discussion

The essence of integrating the students' final year project and the students' industrial work experience scheme into the educational curriculum of the higher educational institutions in Nigeria is to ensure quality assurance (QA) in Nigeria's higher education. The word quality refers to standard or grade of an entity while assurance is synonymous with certainty. To this end, quality assurance in higher education in Nigeria may be said to mean ensuring the certainty of the grade or standard of higher education with respect to Nigeria. And quality assurance in higher education clearly translates to high quality graduates. However, the concept of quality assurance is all involving. According to Okebukola (2010), quality assurance refers to an umbrella concept for a host of activities designed to improve the quality of input, process and output of the higher education system involving several components which he called elements of quality assurance.

Quality assurance is not synonymous to accreditation as it is erroneously conceived in some quarters but accreditation is one of the activities in quality assurance. In the assessment of Okebukola (2010), QA has components internal and external to the institution. He distinguished the two as follows:

- Internal quality assurance to include the internal examiner system and internal academic and management audit. An institution engages in these activities to assure itself that it is on course to fulfilling its vision and mission in terms of quality of input, process and output.
- External validation of institutional quality assurance is often necessary in the desire to norm that institution with others with the same vision and mission. Agents external to the university are players in the external quality assurance system. The key activities are accreditation, periodic monitoring and evaluation by NUC, visitation and external institutional audit. The quality assurance process examines the effectiveness and efficiency of the input, process and output elements of the teaching, learning, research and service activities of a higher education institution.

He professed that the quality of products can be measured by how well the graduates are being prepared to serve society and for meeting the challenges of the world of work. It can be

judged through ascertaining how efficient the teachers are, and the adequacy of the facilities and materials needed for effective teaching and learning. The utility value of quality assurance can be seen through the provision of information to the public and other interested parties about the worth of the higher education delivery system. It equally ensures accountability in respect of the investment of public funds (Okebukola, et al, 2007).

The paper by Ibidapo-Obe, Sofoluwe and Ajibola (2012) focused on the experiences and strategies for enhancing Quality of Learning in Higher Educational Institutions in Sub-Sahara Africa based on information and communication technology (ICT) and was targeted at applying an evolving but excellent management practices institution-wide and at all levels which are concerned with policies and processes related to teaching, learning and assessment in different national contexts considered key management issues to include acting on student feedback, engaging e-learning initiatives, linking research and teaching effectively, leading learning organizations, implementing innovations in education, developing outcomes based courses and applying peer review principles to teaching. The key management issue from the text that concerns this work is the linking of research and teaching effectively. Moreover, the term teaching here is considered within the general context of its paradigm with special emphasis on the concept of SIWES training while the term research means bringing to bear the industry based researchable problem on the students' final project whereby a research problem is defined by the industry in conjunction with the academia. This will give birth to meaningful research efforts that will benefit the country as a developing nation unlike the present trend where the academia is engaged in research efforts that are not targeted towards solving a real-life problem.

In the fifty year assessment of Okebukola, the quality assurance process improved steadily. Improvement in quality of graduates from the Nigerian university system was however found to mismatch the quality assurance efforts. This calls for invigoration of the quality assurance activities at the federal and state levels, Okebukola (2010). The Students' Industrial Work Experience Scheme (SIWES) popularly touted Industrial Training must have been designed to enable students put to use of some the theoretical prowess built into the candidates in order that they may become world-class professionals. The progenitors of SIWES must have designed the scheme to engender a mutual benefit between the industry and the academia for the overall promotion of Nigerian economy. The industry prepares a researchable problem which the students can solve as a team of researchers within the six months of the programme. The industrial experience of the students is thus expected to influence the students' choices of area of research for their final year project. It is the gains of the scheme that is expected to arouse the commitment of the industry and create a bilateral relationship between the academia and the industry. The current practice where students see SIWES as a means to make quick money is a clear departure from the blueprint of the scheme as designed by its progenitors, Ajibola (2011).

In his work, Ajibola (2011) strongly suggested that SIWES should be redesigned in such a way as to accommodate the problems of the industry which the students must solve in stages and the inputs made by individual students should be the yardstick for scoring the students performance at end of the programme. This will enable the industry to make adequate budget for the students' project since the industry expects benefits from the students' effort. The students in turn benefit since it gives them the needed exposure to the procedural processes that solve real-life problems from conception to the close of the project. This must be pursued with vigour.

Conclusion

A systems approach to quality assurance demands that dimensions of input, process and output

should be the focus. The input segment includes students, teachers, curriculum and facilities. On the process side, emphasis is on teaching/learning interactions, internal efficiency, research, evaluation procedure and management practices. The output includes the quality of graduates as well as the system's external efficiency, Okebukola (2010). This paper focuses on the last miles of the undergraduate degree programmes in Nigerian higher educational institutions with the aim of harmonizing all the knowledge acquired by students as input for SIWES but the later serving as input for the students' final project. The process involves administering the by-products of SIWES, industrial exposure, as input variables for the students' final project for good quality graduate that will fit into any industrial setting. Clearly, the output shall be: skilled and employable graduates, responsible citizens, economic and social development, and production of new knowledge.

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