Design of a Work-based Engineering Degree to Up-skill the Workforce in the Northern Sector of the Kingdom of Saudi Arabia

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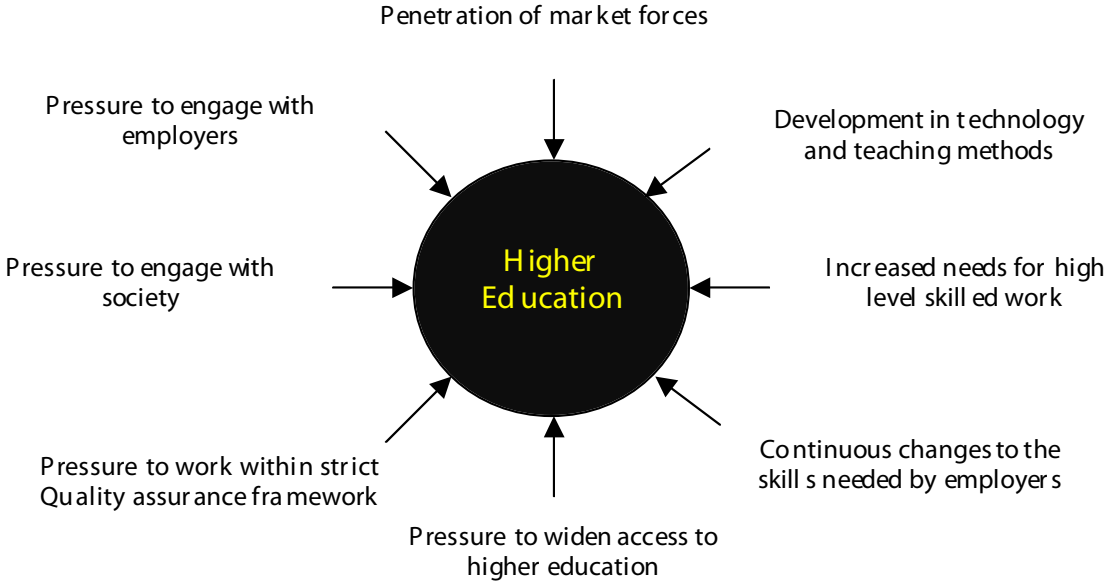
Abstract

Higher Education provision in general and Engineering education in particular has seen significant changes in the last 20 years. One of the main drivers for these changes is the increasing pressure to link higher education with the job market and to embed employability into the curriculum. This is important for developed countries to up-skill their workforce and stay competitive but even more important for developing countries to "catch up" with industrialized countries. In this paper a proposal for a work-based Engineering degree is proposed to up-skill the workforce in the northern sector of the Kingdom of Saudi Arabia. The paper includes critical analysis of the design, contents, delivery and quality assurance.

Introduction

Higher Education provision in general and Engineering education in particular has seen significant changes in the last 20 years (Masri, 1999). The main forces that are driving these changes are (Figure 1):

Figure 1: Main changing forces in Higher Education



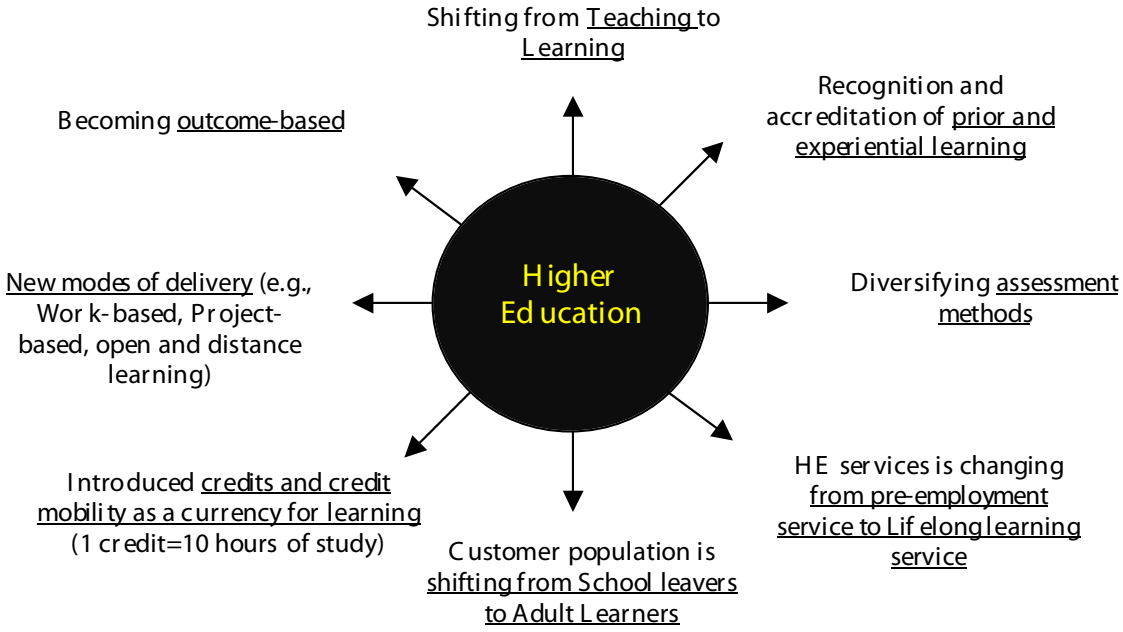
1. Penetration of market forces: This is demonstrated through the competition to attract more and highly talented students and staff, attract more research funds, treating students as customers, promote facilities on campuses, emphasis on efficiency and effectiveness, full economic costing of activities, introduction of league tables, sophisticated marketing activities and many more.
2. Pressure to engage with employers: There is a growing pressure on Higher Education institutions to engage with employers in an attempt to improve the employability of graduates and to provide the skills needed by the

businesses (Archer, 2005; King, 2007).

3. Pressure to engage with society to promote lifelong learning: This is now expressed in the vision and mission of most higher education institutions.
4. Pressure to work within strict Quality Assurance Framework: HE Institutions have to make sure that the awards they offer are "Fit for Purpose" and that all stakeholders are satisfied with the quality of the learning experience offered by the institutions.
5. Pressure to recruit students from diverse background: This is certainly the case with Engineering education where the demand exceeds the supply forcing institutions to recruit from diverse background areas (ELWa, 2005).
6. Continuous change of skills needed by employers: This is most applicable to engineering where the skills needed are changing continuously. Changing patterns of technology and intensified global competition have altered the demand for occupations and skills. Many newly created jobs require higher skill levels as the general trend has shifted away from more routine manual work. Also the skill levels required for existing jobs have been rising. Today, engineers need to learn management skills, marketing, languages, environmental issues, legal issues, and many more skills which traditionally were not considered as core engineering skills (Masri, 1999).
7. Increased needs for high level skilled workforce: this is certainly the case for developed courtiers to stay competitive but even more important for developing countries to close the gap with the industrialized world (Conner, 2005).
8. Development of in technology and learning and teaching methods: The developments in IT technology and the research in developing new learning and teaching methods have created a new environment where learning could be gained by diverse methods, place and time.

As a result of the above forces, the following changes have occurred in developed countries (Figure 2):

Figure 2: Higher Education response to the changing forces.



- Shift from Teaching to facilitating Learning.
- Curriculum becoming outcome-based.
- New modes of delivery have been introduced (e.g., Work-based Learning, Project-based Learning, Open/Distance Learning).
- Introducing credits and credit mobility as a currency for learning (1 credit =10 hours of study at certain level) (Bekhradnia, 2004).

- Our customers are shifting from school leavers to adult learners of all ages.
- Or service is changing from pre-employment service to lifelong continuous development service.
- Diversifying assessment methods using assignments, design projects, presentations, product development, research based projects, etc (Gibbs, 1999).
- Recognition and accreditation of prior and experiential learning based on the key principal that learning does not only takes place in a formal environment but could be acquired through work, life experience, society engagement, self learning, training, etc (William, 2008).

In the last 10 years, significant research has been carried out on "learning through work" which is now well recognised as an effective route for acquiring all the learning outcomes of traditional academic programmes. Today, there are many academic awards which are offered through blended and work-based learning. However, most of these programmes are offered in developed courtiers and very little progress has been made in developing countries where work-based learning is needed most (Farmer, 2004; CIHE, 2005).

This paper highlights the needs for the strategic development of higher level learning in the Saudi workforce in order to boost the economic competitiveness of north region. In particular, it aims to extend the opportunities for mature adults in the Saudi workforce of engaging in a graduate education via the use of innovative blended learning and learning recognition activities. This will allow Fahad Bin Sultan University, in a collaborative context, to play to its strength in designing, assessing and accrediting work-based learning.

Theoretical Background

There is a vast literature related to experiential and work-based learning with much commentary and debate but little on designing academic programmes especially those related to developing countries [1]. Kolb's theory of experiential learning Kolb, 1984) has been used to guide the development of work-based learning curriculum. Kolb argues that:'learning is not fixed and immutable elements …. but are formed and reformed through experience ….[it is] a process whereby concepts are driven from and continuously monitored by experience. Kolb also argues that learning is a process not a product, but that all new learning is relearning which is adapted in the light of new knowledge and/or experience , thus experiential learning can be described as informal learning in that it cannot be 'taught' in a classroom (Welsh, 2008).

> *Work-based learning has increasingly become an area of interest for the higher education (HE) sector. It is seen as means by which to support the personal and professional development of students who are already in work and the focus of the learning and development tends to be on the student's workplace activities*
>
> *(Brennan and Little, 2006).*

Knowledge creation and the deployment of new knowledge in the workplace have given rise to the workplace itself being recognised as a site of learning and knowledge production (William, 2008; Brennan, 2005). This concept is an integral feature of the 'knowledge economy' and the growing intellectual capital of businesses has the potential to erode universities as being the dominant force in knowledge creation. If HE is to continue to make a contribution to the knowledge economy, collaborative activities based in and around the workplace should be considered (Brennan, 2005).

There are many definitions of WBL. The British HE Academy defines work-based learning (WBL) as *learning occurring during paid or unpaid work. It includes learning for work (e.g. work placements), learning at work (e.g. company in-house training programmes) and learning through work, where work-based activities are linked to specific learning objectives (HE Academy,*

HEQC (2004, p. 29) defines work-based learning in a broad way that is closer to work-related learning. Work-based learning: A component of a learning programme that focuses on the application of theory in an authentic, work-based

context. It addresses specific competences identified for the acquisition of a qualification, which relate to the development of skills that will make the learner employable and will assist in developing his/her personal skills. Employer and professional bodies are involved in the assessment of experiential learning, together with academic staff.

Seagraves et al (1996) simple definition of WBL is:

- learning for work

- learning at work

- learning from work

This is explained further in that:

"Work based learning is that learning which …[utilises] opportunities, resources and experience in the workplace. It will, in general, have outcomes relevant to the nature and purpose of the workplace … the learning achieved will include appropriate underpinning knowledge and will be tailored to meet the needs of the student and the placement" (Margham, 1997, P.2).

New Engineering (2007) argues that Work Based Learning Programme is a process for recognizing, creating and applying knowledge through, for and at work which forms part (credits) or all of a higher education qualification.

Smith (2007) argues that developing a new engineering educational set-up, which integrates formal education and productive work is a new challenge. The best way to learn and understand a theory is trying to see whether you can apply the theory in engineering problem solving. Therefore it is obvious to try to combine the academic learning process and engineering problem solving. This has been one of the fundamental reasons for the existing problem based learning concept (PBL). In the light of the experiences from this PBL concept some further development makes it possible to integrate work based learning in academic engineering education (Smith, 2007; Fink, 2001).

A report on 'The Progress of Work-Based Learning in HE engineering programmes' highlights the need for engineering departments "to enhance their capability and capacity to deliver innovative work-based learning solutions to support the national agenda". (Medhat, 2008).

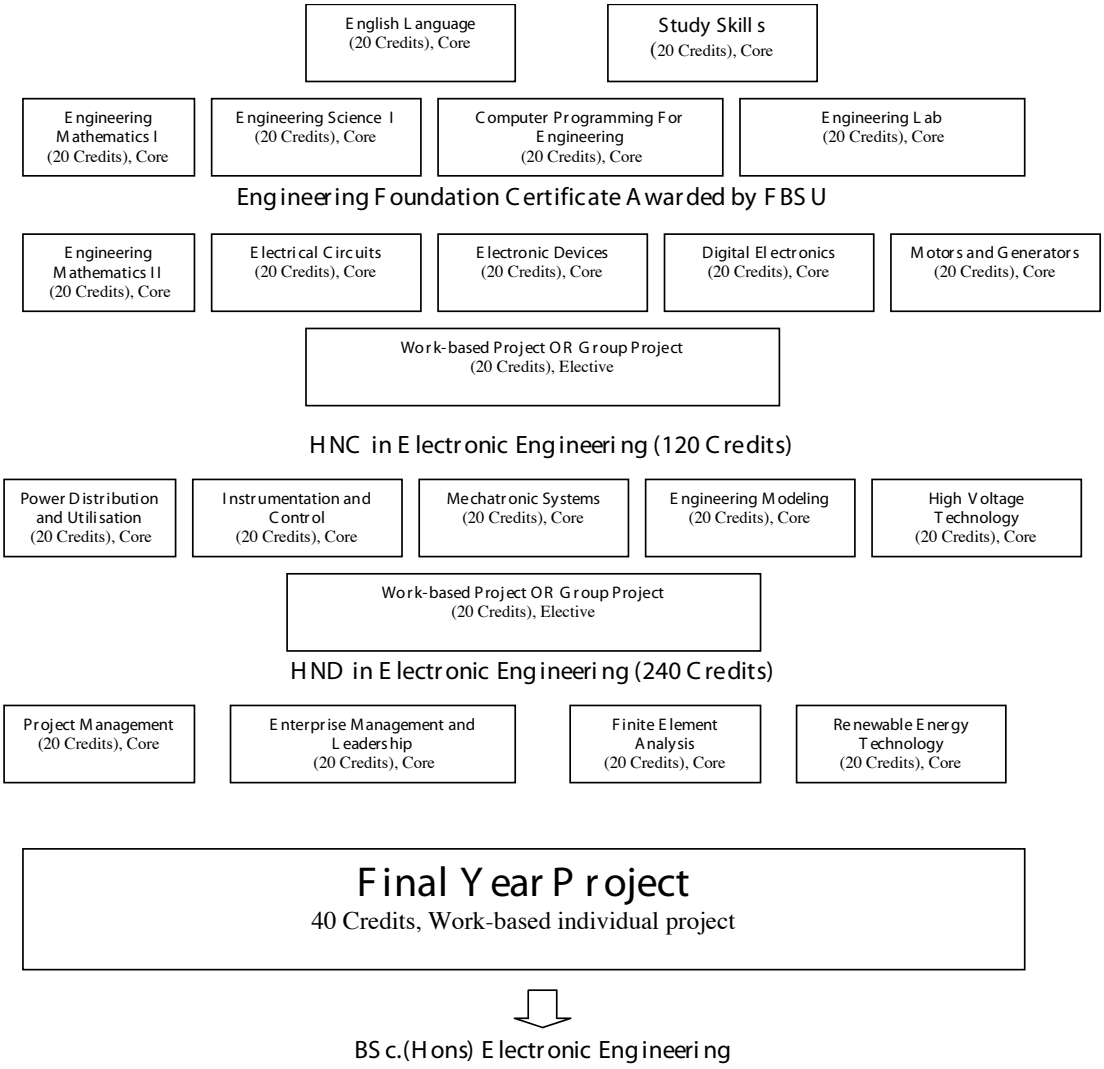
From above it is clear that WBL is redefining the workplace and the classroom and Governments, HE Institutions, employers and professional bodies are all participating in this hot debate.
In this paper, an ambitious and innovative proposal for introducing WBL in the Engineering education of Saudi Arabia is introduced and discussed. It is anticipated that this scheme will contribute significantly to the learning culture in Saudi Arabia.

The Programme Framework

Figure 3 below shows the structure of the proposed programme.

The programme consists of 20 credit modules at levels foundation, 1, two and three. It also includes a final year project with 40 credits. The programme follows the British system where each credit translates into 10 nominal learning hours. After successfully completing 120 credits at level 1, an HNC will be awarded while successfully completing 240 credits 120 of them at level 2 will entitle the student to an HND award. The BSc will be awarded after completing 360 credits, 120 of them at level 3, 120 at level 2 and the rest at level 1. Credits are accumulated after completing each module.
The contents and learning outcomes are derived from the UKSPEC, the Engineering benchmark statement issued by the British Quality Assurance Agency and in consultation with national industries.

Figure 3: Work-based Undergraduate Programmes in Electrical Engineering in Collaboration With a British University



The Programme Delivery

All core and optional modules are offered as credit-bearing short courses. This is an ideal option if learners are keen to update their professional knowledge, enhance their career or sample the programme

Each 10 Credit Module is split into:

- 20 Hours Face-to-Face Lectures (6 Hours Wednesday, 8 Hours Thursday and 6 Hours Friday)

- 20 Hours Supporting Tutorials (6:00 – 9:00PM Saturdays and 6:00 – 8 Mondays for 4 weeks)

- 60 Hours Student Directed Learning Supported by On-Line Material

The learning strategy for these modules requires students to commit 100 learning hours (including assessment), of which 40 hours will be class support and 60 hours will be independent, work-based and self-directed study. The class support is to introduce main theories, concepts and principles provide time for case study work and discussion. Whilst the tutor will input some essential ideas on the main issues on the main issues, candidates will be expected to carry out prior reading of materials, undertake research and take part in group discussions to develop these ideas.

There will be a mixture of activities including lectures, web-based activities, case studies, videos and in-class group discussions, individual and group problem solving outside class, directed reading and problem solving outside class and self-directed learning.

Each Module will be delivered and assessed over a minimum of one month and normally students are allowed to enroll on one module at a time. However, in exceptional circumstances where students are showing ability and capacity to learn fast, they can enroll on two modules. After successful completion of a module, the credits gained are banked and when the accumulated banked credits reach the threshold for the targeted award, the award will be given to the student.

Assessments will be mainly on projects related to the work place and involving critical analysis of applying learnt theories in the workplace. Simulated project and case studies are also used when it is proved to be difficult to find a work-based project. The assessment strategy encourages innovative and critical thinking, problem solving, self reflection and linking theory with practice.

Quality Assurance

The quality assurance of the programme will be carried out by a British university who has a long track record in running work-based learning. The QA processes include:

- Initial approval of the programme.
- Annual monitoring through examining the Annual Programme report which includes students' feedback, employers' feedback, statistical indicators on progression, external examiner report and tutors feedback report.
- Chairing and running the Exam Board.
- Double mark sampled assessments.
- Approval of assessments (exam papers, assignments briefings, projects proposals) and assessment criteria.

Conclusion

This paper presents and discussed a proposal for work-based Electrical Engineering degree designed for the Kingdom of Saudi Arabia. The programme is delivered through accredited training modules, each worth 20 credits, at foundation, level 1, level 2 and level 3. There are 3 early exists from the programme at Foundation certificate (120 Credits at Foundation level), HNC (120 Credits at level 1) and HND (240 credits; 120 at level 1 and 120 at level 2). It is envisaged that the main challenges for the practical implementation of this programme are:

- Persuading potential employers to support the programme not only financially but also through creating appropriate learning environment at work and allocating qualified mentors to support students with their learning.
- Convince the Saudi Ministry of Higher Education and the collaborating British University that there is thorough quality assurance system in place to maintain the quality and credibility of the award.
- Developing and maintaining a student record system that can handle student's credit accumulation.
- Ensuring consistency and equality in assessing work-placed projects.

It is hoped that this programme will stimulate learning at work and will lead to significant improvement in the performance of Saudi Electrical industry.

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