The Students' Standpoint

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Conference Topic: The Global Engineer

INTRODUCTION

The need for highly educated, highly competent engineers to work in a global economy has long been established. Numerous reports have been published over the years regarding the many challenges that engineers face in a modern global society. Globalisation continues to radically transform national economies for the better, despite increasing current demand to meet global markets. Engineers are at the heart of dynamic developments such as the way we design, produce, distribute and consume goods and services [1]. These global markets are increasingly competitive and expect high-performing, globally adept engineers. Industry also demands highly educated engineers who strive for the best in these competitive markets. Thus it is important that higher education institutions (HEIs) and engineering faculty in the UK ensures the delivery of high quality engineering education that considers changing economies and global challenges.

1   GENERAL

The primary stakeholders in this investigation are engineering students from the Faculty of Engineering and Environment at Northumbria University. It is not easy to speak of a unifying engineering education when there is a wide tapestry of discipline specific engineering curricula that are embedded within UK universities, including Northumbria University. Fundamentally, engineering faculties broadly follow the guidelines set in UK-SPEC, or specific institution derivative versions, to adapt to current industry needs and ultimately provide world-class accredited engineering courses.

The term global engineer has loosely been incorporated into the curriculum in the form of adopting and applying sustainability, social responsibility and development to the engineering discipline. There is, however, not one straightforward definition of the understanding of what capabilities a 'global engineer' should possess when entering practice. In addition, the term 'global dimension,' has emerged as a recurring theme, which is quite topical within the engineering education arena. David Parkinson [2] rightfully states that globalisation has aspects related to;

- *economics, free trade, the relationship between poverty and*
- *development internationally*
- *multinational corporations*
- *culture and diversity within the workforce, workplace, home, and society*
- *communication and technology connecting parts of the globe.* [2]

1.1 The Global Engineer

Many definitions of the term have emerged from engineering academics, HEIs such as the Institute of Education London's report on 'The Global Engineer' [3] and engineering organisations such as Engineering Without Borders (EWB)[1]. Both these organisations agree on the global dimension of engineering, taking into account global technological trends, social and political issues including, the human contribution to climate change and an expanding population [3].

In essence the global dimension is the sum of the social, political, technological, cultural, and environmental issues which are shaping engineering at the global level. [3]

Similarly an interesting insight on the global engineer came from the German automotive component manufacturing company Continental AG [1] where their understanding of producing global engineers is to essentially consider the impacts of globalisation on engineering higher education across the globe. A common theme emerged from a previous project [4] involving staff and students at Northumbria University on recognising sustainability within engineering curriculum that the perception of a global engineer should reasonably "*have interdisciplinary knowledge, be multi-literate,* and *be able to cross borders and boundaries (e.g. languages and cultures)"* [4]. The Engineering Without Borders (EWB) Canada had an interesting insight on their expectations of a global engineer, in the sense that an engineer would be able to "*take a broad view in thinking and acting to understand and propose solutions for many of the complex emerging global issues"* by being 'equipped with the core requisite competences' [6].

In addition to the above, a global engineer should also be able to sensibly consider the impact of human behavioural factors on the environment, use resources effectively and efficiently while minimising risks and adverse effects on the society [7]. Furthermore, students felt that the engineering curriculum should highlight the inclusion more practical skills to apply in 'real life' situations [4].

A recent government review makes recommendations for long-term solutions that include strategies designed to attract young people to become future engineering graduates [8]. However, the national engineering curriculum needs modernising and also needs to adopt new effective assessment methods to remain to be seen as one

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[1] Engineers Without Borders (EWB), http://www.ewb-uk.org.

of the most successful global higher educational systems. Engineering students need to be able to engage with their chosen field of study, improving overall student satisfaction, which would reduce rate of attrition [9]. This paper will describe the initial investigation within some of the engineering disciplines taught in the Faculty of Engineering and Environment at Northumbria University. Undergraduates from various engineering disciplines were asked about current study and their thoughts on employability within global markets. These will then relate to opportunities for change within the engineering curriculum, which may promote the enhancement of global engineering education.

2 THE INITIAL INVESTIGATION

The initial stage of this project sought to investigate how engineering students viewed their career prospects on the global market. In addition, the project sought to investigate student confidence in their current engineering degree study and its assessment in providing the requisite skills and attributes that employers look for as perceived by the students themselves. The primary stakeholders were second and final year engineering undergraduate students from the Faculty of Engineering and Environment. These students came from varying disciplines including Mechanical Engineering, Electrical and Control Engineering, and Computer Engineering. These students were asked to participate before the start of their industrial placement year (for second year students) and at the end of their degree programme (for final year students). The motive for this was to gather information about the reasons second year students went on placements, and in which ways they believed the experience would enhance their learning. Final year students were targeted to seek answers on their confidence and satisfaction on some aspects of their chosen degree course, their employability, whether any placement study had any effect on their learning, and their career mobility intentions after graduation.

3 RESEARCH APPROACH

A multi method approach is being used to collect and analyse data. Two sets of questionnaires were designed to ask second year and final year undergraduate students about their thoughts on acquiring global technical and non-technical competences during their course, their degree satisfactions, and their confidence in their employability and career intentions. The survey contained some Likert-scale type questions requiring ranging answers for example 'level of confidence in gaining requisite skills' or 'to what extent' going on a placement had enriched their knowledge and skill set.

Third year students were asked questions that focused on their perception of their global competences gained during their engineering degree programme and their career projections. Students were asked to provide a few minutes of their time to read the information and fill out the questionnaire anonymously.

4   DATA ANALYSIS AND RESULTS

The results revealed some interesting points, some of these answers may have been anticipated while others may not. Below are some of outcomes of the investigation:

1.   Students were asked about their confidence level in gaining the requisite skills (both technical and non-technical) that global job markets expect on a scale 1 to 5 (1 being highly confident and 5 being least confident). The majority (52%) responded positively to having acquired the knowledge and skills for the global economy that employers demand. Unfortunately, 17% did not believe they had gained global skills from their degree course and 31% did not have a specific opinion (*Fig. 1.*).
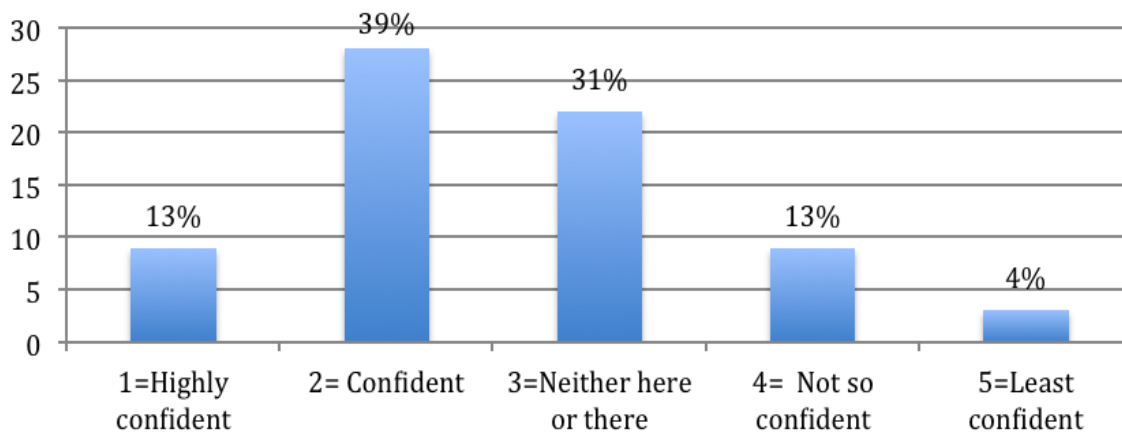

Fig. 1. Confidence in acquiring technical knowledge and skills for global engineering

2.   On a positive note, the majority of students with the intention of going on placement genuinely believe that the experience will improve their global engineering skills (*Fig. 2.*), as well as enhancing their CV strengthening their choices in obtaining a job after graduation (*Fig. 3.*). Those who had been on placement have in fact enriched their global competences and skills that they have learned during their degree course.
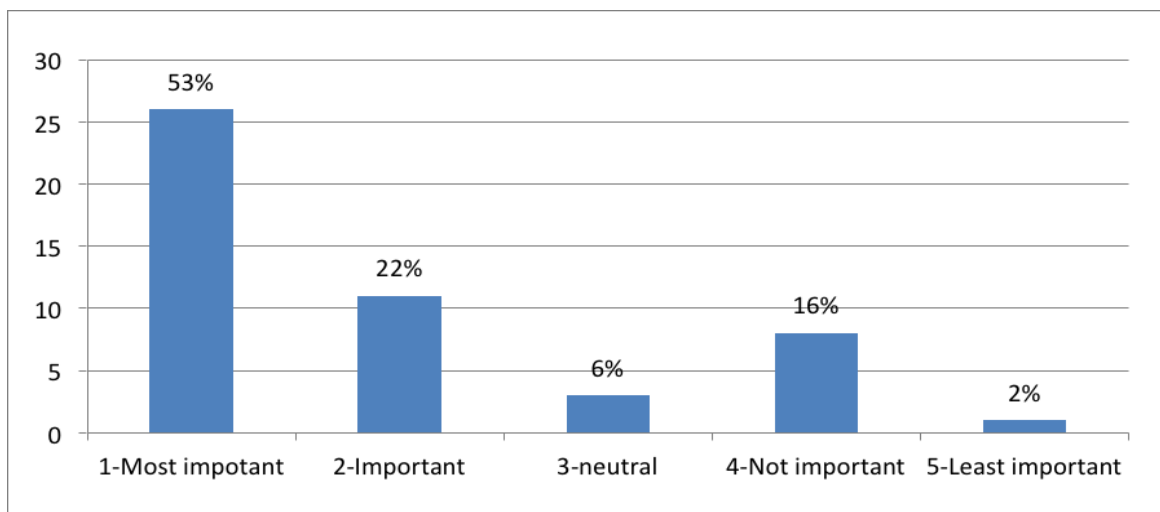

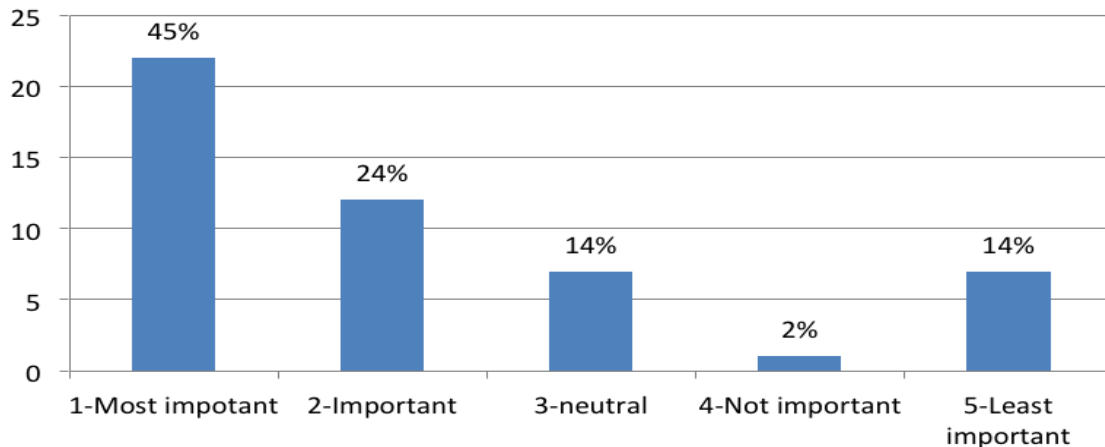*Fig. 2.* Placement experience will improve engineering skills

Fig. 3. Enhance CV and increase chances of obtaining a job

3.   Irrespective of having placement experience, overall, nearly half of the final year students (49%) stated they were either 'very satisfied' or 'satisfied' with this aspect of their degree programme (*Fig. 4.*). Significantly (38%) were neutral and the remaining students were fairly dissatisfied (10%) and least satisfied (3%) of their degree programme (*Fig. 4.*).
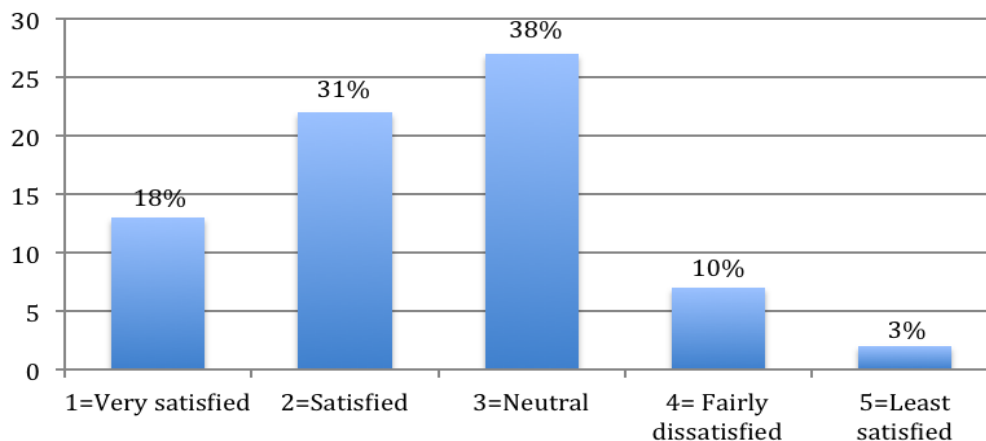

Fig. 4. Satisfaction with the global aspect of their current degree programme

4.   Likewise, in conjunction with the positive response regarding student satisfaction with their degree programme, over half of final year students were mostly confident when asked about their employability after they graduate (51%), as shown in the pie chart below (*Fig. 5.*). It was also found that 13% responded negatively to their readiness to getting a job, which coincidently demonstrated a correlation with their degree satisfaction (13% of respondents were not satisfied that their degree course suitably developed their global employability skills– see *Fig. 4.*).
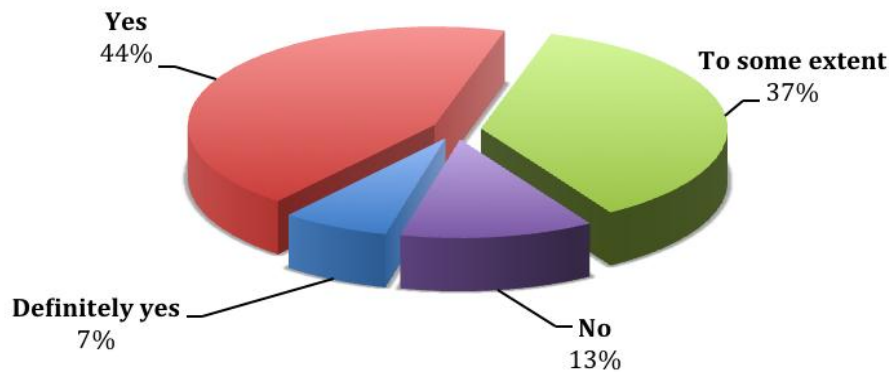
Fig. 5. Employability after graduation

5. Finally, when asked about their career future after they graduate, 42% responded that they would work only in their home country (of which 49% were international students), while only 10% firmly intended to work abroad, and 25% had considered working abroad (*Fig. 6.*). Furthermore, it was found that home students had strong reservations about working abroad; the majority (58%) had firm intentions to work in their home country only while only 6% had strong intentions to find work abroad after their graduation (*Fig. 7.*), which questions the mobility and global aspect of the engineering profession.
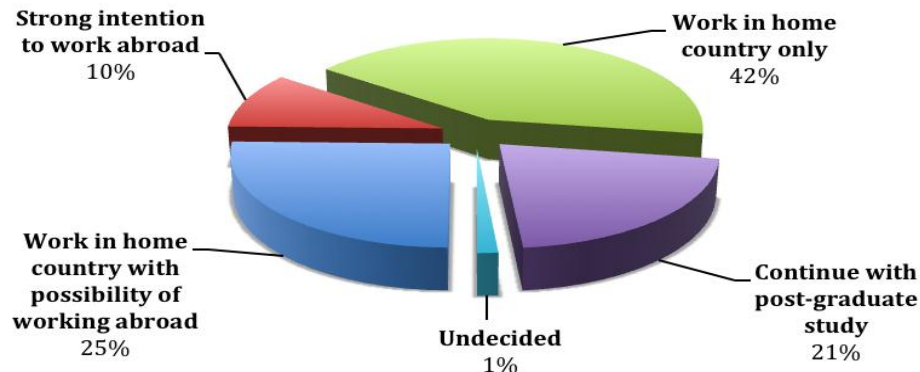

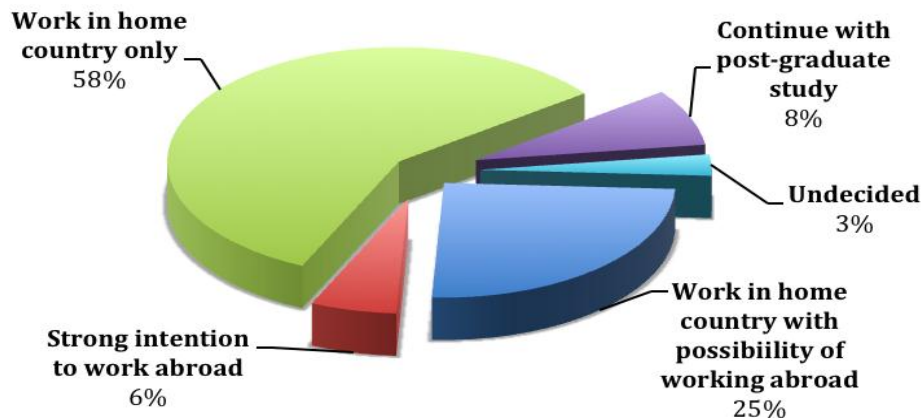*Fig. 6.* Regions intended to work after graduation (all participants)

Fig. 7. Regions intended to work for home students only

5. DISCUSSIONS AND FUTURE WORK

In this investigation we sought to underline the student confidence in their global competences, confidence in their engineering programme, and employability from the point of view of engineering students. It is important that engineering education offers high standards for the future of the profession in a more demanding globalised market. New emerging global engineering challenges need to be addressed and incorporated within the engineering curricula.

The results from this study revealed that despite a high percentage of confidence in gaining the requisite skills from their current degree programme, almost a fifth of engineering students are not convinced that their study equips them to operate in a global context. This situation may be considered to be contrary to the expectation of programmes aligned to UK-SPEC. 13% were not satisfied that their degree course suitably developed their global employability skills although at this point it has not been determined whether these students had or had not undertaken a work placement.

Other parts of this investigations revealed that there is a lack of communication between the engineering faculty and the students in some engineering discipline areas about opportunities of gaining extra competences through placement studies within the engineering job market. As a matter of fact, about a quarter of second year students that were not going for a placement study were completely unaware of such opportunities.

Furthermore, pursuing a career within their home countries is the first choice when seeking for employment. When probed further on the matter, it was disclosed that students feared leaving their home country for various reasons; mostly because they did not feel their language skills were adequate, they *'did not wish or do not feel ready to go abroad yet,'* or because they believe it is *'cheaper to stay within the UK'.* Fig. 6 and 7 demonstrate that students have a poor perception and understanding of global employment activity. Finally, it also brings into question whether they realise the globalised nature and extent of engineering jobs even when working close to home.

In conclusion, the engineering curricula need to be re-assessed and updated to make room for more innovative approaches such as teaching engineering students about the impact of globalisation and what it means to be a 'global engineer' in the 21st Century. Relevantly, it was previously observed by Desha [10] that engineering curricula are *"expected to meet rapidly changing expectations in urgent and challenging times, focusing on engineering education for sustainable development"* [10]. It is important to strengthen communication and awareness between students and faculty to increase opportunities to improve global skills but also generate dialogue to promote globalisation within engineering education.

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