Student Perceptions of "soft" skills in Mechanical Engineering
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Abstract - **It is critical that engineering students develop and enhance basic communication skills i.e. reading, writing, speaking and being professional in the workplace. These skills build a necessary foundation that influences and shapes the types of engineers that institutions of higher learning produce. The importance of these communication skills, often referred to as "soft skills", are downplayed in engineering programmes in favour of an overemphasis on the technical "hard skills". This attitude and practice engenders beliefs and attitudes that the "soft skills" are secondary, even unimportant. As a result, engineering students are often equipped with technical knowledge, but a lack of the "soft skills", leaves them under-prepared for the real world of work**.

This paper explores the notion of "soft skills" in a Mechanical Engineering education environment, with particular focus on student views on the role and value of these skills in educating "new millennium" engineers.

Index Terms – communication skills, "hard" skills, Mechanical engineering, "soft" skills

INTRODUCTION

Engineering graduates are expected to be employable and ready for the workplace when they complete their studies. It is generally expected that graduates should be equipped with a balance of technical knowledge in addition to the relevant "soft skills" required in the workplace. This balance is what gives one graduate competitive edge over another.

Literature relating to "soft" skills suggests that there is no singular definition of this set of skills. Some refer to them as "process skills" [1], "social skills" [2] or "generic skills" [3]. Despite the fact that varying terms are used to define "soft" skills, there seems to be general common descriptions of what these skills include, for example, communication skills, creative thinking skills, team work, the ability to cope with changing situations and so on [1,2].

Graduates are often believed to be less prepared than industry employers expect them to be [4] and "lack the critical soft skills necessary in today's workplace" [5]. In addition, the very skills that are said to make a graduate more employable, are often downplayed in favour of the technical

knowledge. Technical knowledge is fundamental and its importance cannot be disputed, as this forms the general basis from which engineers work. However, technical knowledge alone does not distinguish the best engineering graduate from the rest. "Soft skills" are complementary to the "hard", technical skills and are an advantage to any engineering graduate seeking employment. This is particularly so as current and future engineering students are to become socially responsible and able to fit in with a changing environment where new skills are required, due to technological developments, for example.

It has been noted that skilled employees (highly developed human capital) [6] contribute to productivity and economic performance [3]. A lack of skills therefore, could see a decline in "organizational performance" [3]. In post-apartheid South Africa, productivity and economic performance is crucial to national development. Hence, the premium placed on skilled graduates entering the workplace. It is, however, reported that there is a deficit in the 'soft" skills of South African graduates [2]. This often contributes to and results in a lack of successful employment. Poor communication skills, for example, create a negative impression with employers during the recruitment phase [7] and may exclude a graduate (with good technical skills) from being selected for employment. The language of communication at most higher education institutions and industries is English. Many South African graduates who are English second language speakers may be perceived as expressing their ideas poorly, in English.

Thus, for many South African engineering students it is important to acquire adequate "soft" skills, particularly communication skills (in English) that will make them more employable, in addition to technical skills, since these skills are generally expected to be acquired at Higher Education institutions. This presents a challenge for Engineering Education, not only to develop lifelong learners, but also to bridge the perceived gap between the changing engineering practices and employer expectations, and the engineering curriculum. This paper explores Mechanical Engineering students' perceptions on the notion of "soft' skills, in an attempt to understand what value they attribute to this traditionally downplayed set of skills.

METHODOLOGY

A questionnaire containing 6 questions was administered to a class of fourth semester, part-time (many of these students are employed on a full-time basis) Mechanical Engineering students at a South African University of Technology. 35 students responded to the questionnaire.

The aim of the questionnaire was to illicit responses from students on the role and value of "soft" skills in mechanical engineering in order to gain some insight into their views on this important matter.

It should be noted that the quotations included in the paper are verbatim and have not been edited.

FINDINGS AND DISCUSSION

I. The importance of "soft" skills

The majority of the students were positive about the relevance and importance of "soft" skills. A large number (25) of students demonstrated this positive view by agreeing with the following statement: "Soft" skills are equally important to "hard" skills in Mechanical Engineering. The reasons given for this choice are interesting. The responses show that students have an understanding of the inter-relatedness of the two sets of skills and refer to them as co-existing and being dependant on each other. These responses suggest a more contemporary view of the relationship between the traditionally preferred "hard" skills and the lesser preferred "soft" skills.

The students mention the importance of being team players and being able to market themselves and their ideas. This seems to concur with the notion that successful engineers must be team players, be able to work with others and communicate ideas, in so doing adding "value to their performance" [1].

The remaining responses were in agreement with the statement that "soft" skills are less important than "hard" skills. These responses echo a traditional view that the one set of skills is more important than the other and that they are not dependant on each other. Students might not be averse to the idea of soft skills and admit that these are important, but are superseded by the "hard" skills. One student wrote: "*Soft skills are very important and make you a better engineer, but hard skills are the basics you need to be an engineer.*" Rather than be a "better engineer", the student is content with being just an "engineer", but having the basics.

II. Level of work preparedness and skills upon graduation

The majority of the students responded positively when answering a question on how prepared they think they will be for the workplace and whether they will have all the necessary skills when they graduate. The positive response could be attributed largely to the fact that many of the

students are already employed, despite not having graduated yet. The fact that they already have employment may be interpreted, by the students (as some of them referred to this fact), as being the result of already possessing the requisite skills for the workplace. Thus, they may believe that because they're already employed, that they simply need the qualification to "legitimize" their current positions or to be a motivating factor for a promotion.

The students' comments reflect a rigid understanding of the workplace and what is required of them. For some, the amount of time spent in industry is equated with having all the necessary skills. This is indicated in the following student response to level of skills and preparedness for the workplace: "*Yes, I have been working for 10 years in the Technical department.*" The student believes to have all the skills required and is adequately prepared for the workplace, given the years of experience. Another student confirms: "*Yes, being in a working environment already, I feel that I have all the skill necessary to do the work that has been assigned to me.*"

Some of the responses suggest that some students are learning or enhancing their "soft" skills through their tasks and experiences at the University and having to deal with the academic rigour and the challenging nature of the Mechanical Engineering course. As the following response suggests, "*Yes, because we manage to meet deadlines with small amounts of time here, so to me that means we will cope with the workplace because time will be provided for.*" The student has experienced pressure situations where work had to be produced within a given timeframe and had to learn to "cope" with the situation.

The Mechanical Engineering students have to do integrated projects at all levels of the undergraduate programme. These projects attempt to give students the experience of: working in groups, finding solutions to engineering problems by applying the technical knowledge and skills (usually of a design nature where students have to produce an artifact) and presenting their solutions in oral and written form. For this reason, students who may not be employed also responded that they will be prepared for the workplace as their project experiences have helped them develop their skills.

Some students who are currently also doing their one year of in-service training indicated that they were gaining skills and experience in this way. Other in-service trainees were not as complimentary of the training that they are currently receiving.

Further responses show that students are already aware of the reality that they might not have all the skills required, but might have "a fair amount". Other insight shown relates to the idea that students may have some skills, but each unique working environment, with its own particular engineering practices will determine what is required, and experience can only be gained by being in that environment. Students also acknowledge that the University cannot

provide every kind of learning experience and that it is rather laying the foundation for real world experiences which can only be experienced in the real world of work. One student articulated: "*Engineering has a vast variety of fields that you could encounter and you can only learn from physical experience in any particular field. The institute can only lay the foundation in a student and from there it is up to the student.*" Research does indicate that skills can only be learned if practice is given [1].

The students who indicated that they would not be prepared for the workplace, nor have all the necessary skills when they graduate, attribute this to the fact that the University and industry are different in many ways. What is expected at the University is not always what is expected in the workplace. Thus, there is a gap between what is learned in higher education and what is required in the workplace. This disjuncture has been identified as one of the reasons for the skills gap, because industry and institutions of higher learning do not agree on the skill requirements [8]. Skills gaps are also reported to impact negatively on the performance of organizations [3].

Other responses point to the lack of adequate in-service training where there are no opportunities to apply what has been learned at the University. Furthermore, some students express the sentiment that the Mechanical Engineering course is merely introductory. "*…this course is only an introduction to what they do in the work place*".

III. Important "soft" skills identified

The following table shows the range of specific soft skills that the majority of the students thought that they needed in order to be successful in the workplace. Some of these skills also fall into those identified as "count[ing] most in the global village" [9].

TABLE 1 : Common Skills identified by students

| Project management skills |
| People skills/interpersonal |
| Communication skills |
| Presentation skills |
| Creativity |
| Problem-solving skills |
| Flexibility for teamwork and individual work |

One student pointed out the importance of "people skills" and explained that "*hardened artisans will take them apart*" (referring to students who enter the workplace without this important skill). The image conveyed in this student's response relays the idea of how the workplace can be a scary environment for graduates who are entering (uninitiated) for the first time.

The ability to "*be open and willing to learn*" was pointed out by a student.

IV. "Soft" skills vs "Hard" skills

Students had to respond to the following statement:

"*Soft" skills like communication skills are often downplayed in engineering programmes while technical skills are overemphasized and create the beliefs and attitudes that "soft" skills are unimportant.*"

The responses were positive and students generally emphasized the importance of communication skills. One student points out that "*Communication is a vital part of life in industry. You need to be able to communicate your ideas to others in a professional manner if you want to succeed.*"

One student pointed out that the in-service training experience brought the realization of the importance of communication skills and without this realization, the student would not have known its true importance. Another student responded by saying that the lack of good communication skills could result in management seeing an individual as unable to better themselves, regardless of the amount of technical skills that the individual possesses.

Research suggests [2] that poor "soft" skills are among the reasons why some graduates are not employed. Thus, the opportunity of skills being further developed in the workplace is not afforded to graduates, who may need the opportunity the most. The students who participated in this study, are fortunate to have in-service training as part of their curriculum, but as some pointed out in their responses, the opportunity does not always expose them to the work experiences they require. In addition, some students do not find in-service opportunities. As a result, many do not graduate [2].

CONCLUSIONS

The responses in general were insightful and showed that students, particularly those who have real work experience realize the importance of the relationship between "soft" skills and "hard" skills. In particular, that the two skills are dependant upon each other. Thus, work experience does influence students' views on the skills that are important in the workplace and those that are not.

Of concern are issues like in-service training, in some instances, not providing students with the opportunity to practice the skills learned at the university. Another concern is that students believe that industry expectations are very different compared to those of the university engineering programme that they might not be adequately prepared or might not use what they have learned.

Clearly, there is motivation for a closer relationship between industry and the university. This relationship can

help facilitate "consensus" on what both parties expect from each other and how they can both contribute to the development and experience of engineering graduates. It is clear that students require real, meaningful, work experiences to help them further acquire and develop requisite skills in preparation for the world of work. These experiences could help to ensure that South African graduates, regardless of their skills backgrounds, have equal opportunities to participate in the economic development of the country.

ACKNOWLEDGMENT

REFERENCES

[1]   Woods, R. ; Felder, R.; Rugarcia, A. and Stice, J.,"The Future of Engineering Education III. Developing Critical Skills", *Chemical Engineering Education,* 2000, 34(2), pp.108-117

[2]   Pauw, K.; Oosthuizen, M. and van der Westhuizen, C, "Graduate Unemployment in the Face of Skills Shortages: A Labour Market Paradox", Development Policy Research Unit (DPRU) Working Paper 06/114, University of Cape Town, Rondebosch, November 2006.

[3]   Campbell, M, and Giles, L, The Skills and Productivity Challenge, A summary of the evidence Base for the SSDA'a Strategic Plan 2003-2006, Sector Skills Development Agency. [Online] www.ssda.org.uk/pdf/strat-evidence.pdf

[4]   May, E.; Strong, D, "Is Engineering Education Delivering What Industry Requires?" [Online] www.cden2006.utoronto.ca/data/10053.pdf

[5]   Hissey, T.W, "Enhanced Skills for Engineers (Pt.2): Technical Expertise Alone is not Enough", Today's Engineer Online, August 2002, [Online]www.todaysengineer.org/2002/Aug/skills2.asp

[6]   Lorentzen, J, 2005, "DaimlerChrysler South Africa (DCSA), Human Capital Upgrading, and Regional Economic Development" , Paper presented at the DRUID Tenth Anniversary Summer Conference on Dynamics of Industry and Innovation: Organisations, Networks and Systems, Copenhagen, Denmark, June 27-29, 2005.

[7]   Pauw, K, Bhorat, H, Goga, S, Ncube, L, and van der Westhuizen, C, " Graduate Unemployment in the Context of Skills Shortages, Education and training: Findings from a Firm Survey", Development Policy Research Unit (DPRU) Working Paper 06/115, University of Cape Town, Rondebosch, November 2006.

[8]   Scott, E, Alger, R, Pequeno,S, and Sessions, N, "The Skills Gap as Observed between IS Graduates and the Systems Development Industry – A South African Experience", Informing Science, June 2002.

[9]   "Skills Development in the Knowledge-Based Economy", *Conference Summary Report,* Moncton, New Brunswick, June 22-23, 1999.