

Development of ‘Soft Skills’ Through Extra-Curricular Project Work:

The Case of the Jozi Digital Ambassadors Project in Johannesburg, South Africa

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Abstract—The primary focus of engineering curricula is technical competence. However, literature suggests that a common shortcoming of engineering graduates pertains to so-called ‘softer’ skills such as leadership, team work, time management and communication. Although not core to engineering activity, these competencies are important in the workplace and included in the exit level outcomes of accredited degrees. Development of these competencies can occur by giving engineering students the opportunity of involvement in extra-curricular projects that develop such complementary competencies. This paper discusses the Jozi Digital Ambassadors Project as one such opportunity. The project was launched by the City of Johannesburg, and aimed to roll-out free Wi-Fi to 700 000 Johannesburg residents who previously had no access to free public internet. A further aim was to provide training to these residents regarding how to access the free Wi-Fi and the online services offered by the City. ‘Digital Ambassadors’, unemployed young people who reside in the areas concerned, were appointed to undertake this training on behalf of the City. The University of Johannesburg, tasked with providing mentorship to these ambassadors, identified engineering students who were appointed as mentors. Structured interviews with the mentors were conducted at different stages of the project. The focus of the interviews was on the students’ motivation to participate in the project and their skills development. The development of complementary competencies was one of the factors that motivated the students to join the project and their involvement in the Digital Ambassadors project gave them opportunities to develop leadership and communication skills in a way that the formal university curriculum did not.

Keywords—*engineering education; project-based learning; curriculum; graduate attributes*

I. INTRODUCTION

The primary focus of engineering curricula is, rightly so, the technical competence of graduates. However, there is increasing recognition of the fact that engineering professionals need to be more than simply technically competent. There are myriad complementary competencies required for successful entry into the engineering workplace. These include the need for multidisciplinary thinking, interpersonal skill and effective communication [1]. Also important are effective team work, leadership skill and time management.

This paper aims to discuss the possibility of using extra-curricular, project-based work to develop such complementary competencies. It does this using the case of the Jozi Digital Ambassadors Project, a social development initiative undertaken by the City of Johannesburg, South Africa, to narrow the ‘digital divide’ within the City. The paper is structured such that it begins by providing an overview of the literature relevant to the development of these complementary competencies, or ‘soft skills’, as they are often termed. Thereafter, background pertaining to the Digital Ambassadors Project is provided before the methodology used to collect data is detailed. The results are then discussed before conclusions and recommendations are drawn.

II. COMPLEMENTARY COMPETENCIES IN THE CURRICULUM AND WORKPLACE

The professional engineer is "one who has attained and continuously enhances technical, communications, and human relations knowledge, skills, and attitudes, and who contributes effectively to society by theorizing, conceiving, developing, and producing reliable structures and machines of practical and economic value" [2]. This definition emphasizes technical knowledge and skill, but nonetheless includes a focus on complementary abilities in communication and interpersonal relations. This reflects the fact that broader society most values engineers’ technical skills, while within engineering organizations, non-technical or complementary competencies are highly prized. This is borne out in the literature: the World Chemical Engineering Council [3], based on a survey of employers, finds that the most important graduate attributes are teamwork, effective communication, self-learning, and the ability to gather and analyze information. Similarly, Maturro [4], in a survey of job advertisements for software engineers, finds that equal, if not greater, attention is given to so-called ‘soft skills’. As a result, it is evident that the development of these complementary competencies enhances the future employability of the engineering graduates that institutions of higher education produce [5].

The importance of these competencies is further reinforced in the standards for engineering degree programs developed by organizations such as the Engineering Council of South Africa (ECSA) or the Accreditation Board for Engineering and

Technology (ABET) in the United States. The student outcomes prescribed by both ECSA and ABET require that engineering graduates should display an ability to work effectively in diverse and multidisciplinary teams, and communicate effectively with a range of audiences and in a range of formats. It is thus evident that a premium is placed on the development of skills such as communication and team work. This is evident in both the expectations of professional, regulatory bodies as well as those of potential employers.

However, engineering curricula are often overloaded, with little room to focus on the development of such skills within the formal curriculum. Although formal attention to these competencies must be provided for within the curriculum, there is also value in having engineering students become involved in extra-curricular project work that develops such complementary competencies. In this paper, we provide discussion of one such instance, the Jozi Digital Ambassadors Project.

III. JOHANNESBURG AND THE DIGITAL AMBASSADORS PROJECT

Johannesburg is the economic hub both of South Africa and one of the major economic centers of the African continent. Despite this, it is characterized by high levels of economic inequality, one of the side-effects of which is a significant divide within the population in terms of access to information and communication technologies. Numerous residents have limited access to computers and internet services. However, cell phone penetration is high in the city, with the vast majority of adults owning a cell phone, often an internet-enabled smart phone. Given this so-called 'digital divide', the City of Johannesburg launched a project that aimed to roll-out free Wi-Fi to more than 700 000 of the City's digitally marginalized residents.

Given the lack of exposure of many residents to internet services, it was necessary to embark on a community awareness drive to inform residents about the Wi-Fi, how to access it, and how to use it to access various services offered by the City (including transportation information, an online education platform, an online health portal, amongst other services). To this end, the City launched the Digital Ambassadors Project, which sought to place up to 3000 unemployed youth in the areas covered by the Wi-Fi with the goal of training residents. Each Ambassador was tasked with training up to 240 residents, and received payment for each resident successfully trained.

The University of Johannesburg was tasked with the training of the Ambassadors. In order to assist the Ambassadors, mentors were appointed whose role was to mentor and guide a group of up to ten Digital Ambassadors. These mentors were drawn from the pool of current students at the University of Johannesburg. Because the project was housed within the Faculty of Engineering and the Built Environment, many of the student-mentors were drawn from this Faculty. The mentors were assigned to a group of Ambassadors and received remuneration for their efforts.

IV. DATA COLLECTION AND ANALYSIS

As already mentioned, the aim of this study was to ascertain the impact that involvement in the Digital Ambassadors Project had on the engineering students appointed to act as mentors,

particularly as this related to the development of 'soft skills', those competencies that are complementary to the core technical competencies required of engineering professionals. In order to achieve this aim, the student-mentors were interviewed, at different stages of the project, using a semi-structured interview protocol [6]. The interview protocol included specific questions but there was scope within the interview for the interviewer to ask additional, follow-up questions as necessary.

In total, a sample of ten engineering students were interviewed about their experiences as Digital Ambassador mentors, with each interview lasting approximately half an hour. Thus, approximately five hours of data was collected. The interviews includes questions about the mentors' reasons for signing up to the project, their previous mentorship experiences (where applicable), as well as what skills or attributes were necessary in order to be a successful mentor. The interview also required participants to reflect on their own strengths and weaknesses and develop a metaphor for their experience of being a Digital Ambassadors mentor.

All the interviews were conducted by the authors and then transcribed by a research assistant. Transcription of the data was important as this enabled qualitative analysis of the interview data [7]. The interview transcripts underwent thematic content analysis so as to ascertain the primary themes identifiable within the data. This involved grouping similar statements from the interview data and identifying those themes that emerged most strongly. To this end, the main themes that emerged pertained to the development of communication and leadership skills. While other themes emerged less strongly, we focus here on the two major thematic concerns.

V. DISCUSSION

Anecdotally, it is common to hear of talented and intelligent individuals who lack ability to work in teams, communicate with peers or potential clients, or maintain professionalism. This impacts negatively on the effectiveness and growth opportunities of these individuals, and the teams and companies with which they work. Barnello et. al. [8] argue that so-called 'soft skills' play an important role in differentiating potential engineering candidates for employment. In the day-to-day work of engineers and technical specialists, these soft skills – we prefer the term 'complementary competencies' – are critical components of success. Engineering graduates are expected to live and work competently, competitively and ethically as global citizens, in a rapidly changing, interdisciplinary environment. They need to be aware of how engineering activities contribute to society and impact on the environment. According to Crawley et al. [2], engineering students must "learn how to merge physical, life, and information sciences at different levels, embrace professional ethics and social responsibility, be creative and innovative, and communicate effectively". Furthermore, the call for soft skills has gained support in virtually all fields of industry [9]. This is also the case in engineering where much of an engineer's time is spent communicating technical details to various audiences [10]. Evaluating the JDA mentors' motivation to participate in the program, and the major themes highlighted by the participants, underscores the fact that the development of these skills is often inadequate within the engineering

curriculum, and that students seek out opportunities to sharpen these skills elsewhere.

A. Major Theme 1: Communication Skill

The skill of effective communication is core to successful accomplishment of engineering work [2, 9]. Although there is some focus on the development of communicative proficiency within formal engineering curricula, this often fails to adequately prepare students for the communicative demands of the engineering workplace, where a plethora of genres and contexts exists. Also, students often do not take such efforts seriously because they do not perceive benefit therein for their imagined careers.

However, in their work as Digital Ambassador mentors, the participating students received significant opportunities to practice informal, project-based communication across various communication channels. The mentors were required to organize and manage regular meetings with their assigned Ambassadors. They also handled queries that reached them via e-mail, instant messaging or telephone. The mentors also channeled messages between the Ambassadors and project administrators. The mentors commented on the need to pitch their communication at the level of the digital ambassadors, and that much of their success could be attributed to respectful communication between them and the ambassadors.

Developing effective and relevant communication skills may be of benefit to these students in their later careers, as such skill regarding interpersonal communication across various media and channels is increasingly important in the workplace. It is particularly important in engineering, where students often enter into engineering study because they perceive themselves as being poor communicators. It is also important in a linguistically diverse context such as that of South Africa, where English is the home language of a small segment of the population, despite being used as a lingua franca in a majority of contexts. One of the mentors stated that:

us as engineers, we don't know how to communicate at times, and it [the experience of being a mentor] really teaches you how to communicate with people and it is so interesting because we only learnt it now.

B. Major Theme 2: Leadership Development

The modern engineering workplace is increasing in pace, and flattening out in terms of structure [11]. This means that engineering graduates are increasingly required to exercise leadership and management skill from early on in their careers. However, the formal engineering curriculum offers little opportunity to develop leadership potential. As such, extra-curricular, project-based learning opportunities such as that offered by the Digital Ambassadors Project offer rich potential for students to acquire experience in leadership roles.

One of the aspects that the participating students spoke about regarding leadership was understanding and employing the traits that, they argued, made for good leaders. These traits included: patience, respect for others, tolerance, negotiation, recognizing excellence, conflict management, and professional conduct. These traits emerged as important during the interviews that were conducted with the Digital Ambassador mentors, as indicated in the following quotations from the student data.

make sure that you keep it in a professional level cause some other people come to you in a different way. Yah, keep it professional and make sure that you do your job, you succeed in what you do

honesty discipline and trust it is of vital importance because if you are not a person or a man of your word then the people that are following you they are not going to believe you it might just happen drastically and at the end you might lose their trust and respect which is not viable.

or when someone does something good you need to know how to appreciate that or show that to someone and that's not something you learn on a day to day basis, I mean I only learnt that in this program for example if one of your ambassadors does something good you can send them a text so that they see you acknowledge they are working hard and doing something good and that will boost their confidence, it uplifts them in a way.

maybe if you talk with them they don't want to listen to you, they want you to listen to them, I say okay, when you listen to them and they tell you their problems and you say okay this is what you can do, but they want to do it their own way, but it doesn't work ... sometimes when they argue you say okay, try that way but if it doesn't work can you please try my way.

Such learning is important as it helps students reflect on their leadership qualities and become the kinds of leaders they envision as being 'good'.

Another important aspect that emerged from the interview data pertained to the need to motivate team members in the face of adversity. This was important because there were numerous technical challenges regarding the roll-out of the Wi-Fi hotspots, which meant that the Ambassadors were, for periods of time, unable to conduct any training. Though problematic, this frustration gave the mentors the opportunity to exercise skill in keeping their assigned Ambassadors motivated, and gave them exposure to the need to manage expectations and re-align goals in the face of setbacks encountered. The mentors were able to share numerous success stories in this regard, such as in this extract from the interview data:

it was out of my control but me as a mentor I had to motivate my people to keep on working because they wanted to give up, they wanted to quit, they lost all hope in the program so I had to calm them down and talk to them and explain you don't have to give up now because of this issue, this is just a minor issue you have to look at the bigger picture that's more rewarding, and luckily no one quit the program, they all continued

C. Cross-Cutting Issues: Self-Efficacy and Reasons for Joining

Analysis of the interview data reveals that the students' decisions to apply for and participate in the Digital Ambassadors project was to acquire skill in, exposure to, and practice with the

complementary competencies that are the focus of this paper, particularly leadership development and, to a lesser extent, communication skill. Some of the student-mentors cited the lack of exposure to such competencies in the formal curriculum. For example, one student states that:

I have been doing the engineering degree for four years now, we haven't been taught leadership skills or any skills like that, but being a mentor for the digital ambassadors, I mean it taught me so much about people because you work with different people of different ages, they all different, they all have different needs but you as a person need to manage them like you need to work with them in a way that they are comfortable so you don't create any conflict so I really learned a lot

Quotations such as this indicate that there is a need to develop such skill, and desire on the part of students to be exposed to such opportunities.

Furthermore, one of the primary outcomes of the students' involvement as mentors in the Digital Ambassadors project is the development of their own sense of self-efficacy regarding these complementary competencies. Again, this was evident regarding both leadership and communication skill. Regarding communication, for example, one of the mentors states that:

initially I thought I wasn't good talking to people. I remember back at home they wanted me to do medicine. I was like, no, I can't talk to people, so I don't think that would work for me, so, okay, I did engineering, and when this came I decided to challenge myself. I said okay let me see how this is going to go. So okay, I went for it, then I said okay, this is not bad, people are not impossible to deal with.

Similarly, with regard to leadership, one of the student-mentors reports that:

I feel proud of myself, I feel wow I can do this, I mean I have people who consider me as a leader and still like me, when I talk to them they listen to me, you know how good it feels when you talk to people and they listen? ... Now I know so even I can go to a certain company, of course challenges will be different, but I will have an idea of what I can do with my team to manage them, even if it's not much but I think from that something little I can build something big

The development of a sense of self-efficacy is an important part of the development of a professional. This is because individuals with a high sense of self-efficacy are more likely to take risks, set (and meet) goals, self-regulate, and work hard [12]. A number of student participants, like the one quoted above, reported feeling proud of what they had accomplished and that they had an improved sense of what they were able to achieve in terms of either leadership or communication, or both. The achievement of such a sense of self-efficacy should be an important higher education goal.

VI. CONCLUSION

Technical competence is fundamental to the successful completion of engineering activity. However, such activity takes place through the application of complementary competencies such as interpersonal communication, leadership, teamwork, and so on. It is virtually impossible to pursue modern engineering work without a basic measure of skill in these complementary areas. In this paper, we have used the case of the Digital Ambassadors Project undertaken in Johannesburg, South Africa, to show how extra-curricular, project-based learning of these complementary skills can be fostered.

In our qualitative analysis of interview transcripts with engineering students appointed to act as mentors, we found that the student-mentors cited the acquisition of communication proficiency and leadership skills as the primary benefits they derived from their participation in the project. It also emerged that the student-mentors sought out the opportunity in order to develop these skills, as they perceived their development as lacking within the formal curriculum. Furthermore, participation in the project enhanced the students' sense of self-efficacy which may have long-term benefits regarding their career development. As such, extra-curricular, project-based work can be used to enhance student learning regarding competencies that are complementary to engineering activity, and institutions of higher education should seek to provide such opportunities for their students.

REFERENCES

- [1] R. M. Felder, "A whole new mind for a flat world". *Chem. Eng. Ed.*, vol. 40, iss. 2, pp. 96–97, 2006.
- [2] E. Crawley, J. Malmqvist, S. Ostlund, & D. Brodeur, *Rethinking Engineering Education: The CDIO Approach*. New York: Springer, 2007.
- [3] World Chemical Engineering Council, *How Does Chemical Engineering Meet the Requirements of Employment*. Frankfurt: World Chemical Engineering Council, 2004
- [4] G. Matturro, 2013, "Soft skills in software engineering: A study of its demand by software companies in Uruguay". 6th International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE), Retrieved from: <http://www.ort.edu.uy/fi/pdf/softskillsmatturro.pdf> on 8 November 2016.
- [5] M. S. Rao, "Enhancing employability in engineering and management students through soft skills", *Ind. & Comm. Training*, vol. 46, iss. 1, pp. 42-48.
- [6] A. Fontana & J. Frey, "The interview: From structured questions to negotiated text", in: N. K. Denzin & Y. S. Lincoln (eds), *Handbook of Qualitative Research*, Thousand Oaks: Sage, 2000.
- [7] D. Silverman, "Analysing talk and text", in N. K. Denzin & Y. S. Lincoln (eds), *Handbook of Qualitative Research*, Thousand Oaks: Sage, 2000.
- [8] M. Bernelo, S. Honsberg, A. Järelöv, J. Blennow & L. Peterson, "May an increased focus on students' personal development contribute to increased motivation, better academic performance and teamwork in engineering programs?", *Proceedings of 7th International CDIO Conference*, Copenhagen, Denmark.
- [9] G. Sulcas & J. English, "A case for focus on professional communication skills at senior undergraduate level in Engineering and the Built Environment", *Southern African Ling. & Appl. Lang. Studies*, vol. 28, iss. 3, pp. 219–226.
- [10] M. Ostheimer & E. White, "Portfolio assessment in an American engineering college", *Assessing Writing*, vol. 10, pp. 61–73.
- [11] J. V. Farr & D. M. Brazil, "Leadership skills development for engineers", *Eng. Man. Journ.*, vol. 21, iss. 1, pp. 3-8.

- [12] E. Jones, "Predicting performance in first semester college basic writers: Revisiting the role of self beliefs", *Contemp. Educ.Psych.*, vol. 33, pp. 209-238.