

A challenge to engineering education in SA

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A common starting point for a discussion on the state of engineering education in South Africa is to look at the statistics representing engineers as a proportion of the population; a comparison with advanced economies, who typically have in the order of 10 times more engineers per unit population [1], would seem to suggest that we could do with more. Taking this further, I would like to suggest that a good engineering degree is a springboard for a wide range of involvements in society.

Clearly – for the sake of the economy, and for the profession - we do need to be able to attract the majority of our graduates into conventional engineering work, but the more engineering graduates we have in government, in the financial sector, in the NGO sector, in education, and so on, the more healthy a society we will have. The engineering degree is an extraordinary higher education qualification which involves a strong technical and mathematical basis, a particular orientation towards problems in the real world, and a training to act as a professional. It is no wonder that our graduates are in demand in a range of careers and this seems to me a very natural development if we are to be moving towards what is termed the ‘knowledge economy’.

Using a sociological perspective I would like to add a further motivation for increasing the number of engineering graduates. The engineering degree is a traditional route into the middle class for a bright young teenager from a poor family. There are some of the best possibilities for bursary funding in this area and there is the assurance of a professional and well-paying job on graduation. Concerns have been voiced about whether students are coming into engineering ‘for the wrong reasons’; here it needs to be noted that passion for your subject area grows while at university, and that lecturers have a key role to play in that regard. Lecturers should be more than happy to work with a young person who is good at maths and science and who saw this as a sensible career choice; their role is to switch him or her on to engineering.

A recent Council on Higher Education study analysed in detail what happened to all students in this country who entered tertiary education in 2001 [2]. Of all of those students who started a BSc Engineering degree in 2001, 54% had graduated after 5 years, and 19% were still registered – leaving about a quarter who have left without graduating.

This study also gives the throughput statistics for the national diploma. Of those who registered for the engineering diploma in 2001, only 17% had completed the qualification five years later and 14% were still registered. These statistics offer a clear conclusion: We need to do something better with the students who do come into our system. No selection mechanism is perfect, but there is no other group of students out there who are going to do better than those we do select. I would like to

suggest that there are two levels on which we need to address this situation, namely, teaching and curriculum.

In the arena of teaching, each individual lecturer in the system has the power to make a difference. The research literature is clear on what makes the difference; effective university teachers connect with their students and their learning [3]. The university is an anonymous space and it makes a huge difference when any person in authority gives you the time of day.

Obviously, university lecturers have to be subject experts but here we need to realise that good teaching demands all this plus more. We tend to think of our time commitment for teaching as involving lecture preparation and delivery: the time needed for the setting and marking of tests and exams is not allocated up front and thus these core activities get completed late at night or during the weekends in a mad rush. We need to prioritise the time to be able to return marked assessments timeously to students: if a test is returned late, the moment for learning is often lost. The system needs to support academics putting time into their teaching. Things that help in this regard are systems of promotion that give sufficient weight to teaching capacity alongside research; and industry subventions of academic salaries to attract talented people into academic careers and to keep them there.

Good teaching is crucial, but if we really want to improve the system we are also going to have to address the curriculum. Engineering curricula around the world are shifting towards what are seen as the 21st century priorities for the profession. I would argue here that the curriculum also needs to be responsive to the students entering the system. A very helpful framework for thinking about curriculum is that provided by Ronald Barnett and Kelly Coate which identifies three dimensions of knowing, acting and being [4]. Knowing and acting are verbs for what we commonly think of as knowledge and skills. The inclusion of 'being' takes us into a new paradigm for curriculum.

With our obvious focus towards what engineers need to be able to *do* on graduation and our outwards orientations towards our various 'stakeholders' it is understandable that engineering education has had a strong focus on 'skills'. This can be seen in our shift to outcomes-based accreditation, which I think has been a valuable tool for making sure that we can demonstrate these capacities in our graduates. However, in the rush for skills I think there is a real danger that we can neglect 'knowledge' and 'knowing'. Sociologists of knowledge have demonstrated that the strength of the strong professions such as law, medicine and engineering lies in their strong conceptual core.

These are substantial challenges for us as a community of engineering educators. We need to build better on our collective resource to develop the teaching and curricular interventions that are needed to produce real change. The formation of a Society of Engineering Educators is thus a most timely development.

1. Lawless, A., *Numbers & Needs: Addressing imbalances in the civil engineering profession*. 2005, Halfway House: South African Institution of Civil Engineering.
2. Scott, I., N. Yeld, and J. Hendry, *A case for improving teaching and learning in South African higher education*. 2007, Council on Higher Education (CHE) and Higher Education Quality Committee (HEQC): Pretoria.
3. Ramsden, P., *Learning to teach in higher education*. 2nd ed. 2003, London: Routledge.



4. Barnett, R. and K. Coate, *Engaging the curriculum in higher education*. 2005, Maidenhead, UK: Society for Research into Higher Education & Open University Press.