Professional expectations and personal motivations: Science and engineering graduates' reflections on their role in society

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CGHE webinar series: Exploring the outcomes of educating scientists and engineers

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Economic and Social Research Council

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Graduate Experiences of Employability and Knowledge (GEEK) Project 2020-2023

UK Team: *Paul Ashwin, Jan McArthur, Kayleigh Rosewell, Dee Daglish.*

South Africa Team: *Margaret Blackie, Reneé Smit, Ashish Agrawal.*

US Team: *Jenni Case, Nicole Pitterson, Alaa Abdalla, Benjamin Goldschneider.*

- Part of a 7-year longitudinal study of Chemistry and Chemical Engineering students;
- Previous CGHE project, we tracked them through their undergraduate degrees in 12 departments in England, South Africa and US (42 chemistry and 43 chemical engineering students);
- Continuing to follow them after graduation to examine how they draw on the knowledge and experiences they gained at university (38 chemistry and 33 chemical engineering graduates).

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Protocol Design

- What are the most important things that you gained from studying Chemistry/Chemical Engineering?
- What did you hope to gain from being at university? Did you achieve what you had hoped to gain? How?
- What relationship do you see, if any, between assessment tasks undertaken at university and what you later go on to do in work and society?
- Who do you see yourself becoming in 10 years? How is this informed by what you studied? How is this informed by what you are doing now?
- Do you think you changed as a person as a result of going to university? If so, how?

Engineering programs overview

England: 3-4 years (accelerated Master's, placement)

South Africa: 4-5 years (study abroad, internships)

US: 4-5 years (optional co-op)

Types of trajectories after graduation:

- Graduate school: medicine, nuclear engineering, datascience, process engineering, etc
- Industry: Chemical processing, defence, patent attorney, consultancy, energy

Developing transferable skills and engineering mindset

- A solution to every problem
- Thought process and the mindset
- General knowledge and problem solving skills in contrast to specific engineering knowledge
- Leveraging these skills in their jobs and in personal life

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Developing transferable skills and engineering mindset

Lucas graduated from Erbium and is now pursuing a PhD in materials science

There aren't a lot of degrees that are tailored towards solving problems that we face a lot in life on a larger scale probably compared to just everyday common problems…Year 6

Nina graduated from Samarium and is an account manager in Mining industry

Learning to work in a team.. learning the principles of hard work and commitment. And then also just how to solve problems...Year 7

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General vs. specific appreciation of disciplinary knowledge

- Developing an “Engineer” identity and moved away from the “Student” identity
- Interests beyond subjects, and looking into the consequences of their profession
- Contrasting engineering to other fields and reflecting on the nature of the discipline

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General vs. specific appreciation of disciplinary knowledge

Laith graduated from Erbium and is a Tech consultant and a part-time CS master's student

Because I learnt about chemical processes and how things are made and how chemical plants work, I could read a newspaper article or a statement by a politician or someone who owns a company, and I could tell that that's probably a lie because I've actually learnt the way it works. Year 7

Interplay between personal identity and university experience

- More confident, social, and independent
- Bringing their unique experience and diversity forward for a better world for everyone
- Helping others choose a similar path
- The university experience helps “shaping you into what you want to be”

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Interplay between personal identity and social responsibility

Annie who graduated from Argon and pursuing a master's in nuclear engineering

I want to promote that anyone can do engineering, and that may mean that we have to help some of the students a little bit more who are in the minority succeed so that way they can be that person for someone else and they can be a role model for other students in the future.. Year 6

Conclusions from Engineering Data

- A lot of them talked about engineering way of thinking, engineering knowledge, and other skills they learned e.g. soft skills, leadership, in their careers
- They started developing an engineering identity and moved away from the student identity
- No explicit parallels drawn between the profession and issues behind it e.g. social good
- The graduates haven't yet (at the point in time of the interviews) developed a strong sense of their role in society

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Chemistry Graduates

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Description of Chemistry programs

UK: 3-4 years (accelerated Master's, placement)

South Africa: 4-5 years (study abroad, internships)

US: 4-5 years (optional co-op)

Types of trajectories after graduation:

- Graduate school: Chemistry, Medicine, Chemical Engineering
- Industry: National labs, pharmaceutical companies,
- High/Secondary school teachers

A career in chemistry is more than technical knowledge..

Seeing the day to day value of traditional technical skills but that other skills are required as well,

Apply robust employability skills to everyday issues,

Disciplinary focus has broadened to see a wider landscape,

Finding their place in the world,

Being able to connect with people - build relationships.

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A career in chemistry is more than technical knowledge..

Harold, graduated from Europium, Quality Control Analyst.

It has given me the skills to go out there and be able to perform diagnostic testing on things like Covid. Being able to understand what is going on in terms of, "How am I going to get a result and see, okay, this is what is happening or this person is negative, this person is positive." You know, those kinds of things, it has given me that kind of skill to learn and to go and use them out there in order to be able to make a difference in the community - Year 7

A career in chemistry is more than technical knowledge..

Salma, graduated from Sodium and is now pursuing a Masters

I'm going to make an effort and I'm going to make something of myself. Not saying that if you don't go to university, it's not something. You can go in any direction you choose, but I think if you do decide to go into tertiary education, you should make the effort and try and grow as much as a person. I think that's the most interesting thing to me, like when you know the background of what happens, but to apply it to different situations with everything that you've learnt. And also, I see it as a food scientist's job almost to raise awareness as you go along or try and educate people as you go, - Year 5

Being able to use their scientific knowledge while also continuing to develop personal transferable skills…

Having a good foundation of knowledge,

Competence in scientific literacy and how to engage with research papers or products,

Learning how to manage stress, meet deadlines, manage time, prioritise and develop confidence in their abilities,

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Being able to use their scientific knowledge while also continuing to develop personal transferable skills…

Mason, graduated from Sodium, took a gap year, pursuing another degree at Sodium

Other than a degree itself. I guess it's a platform on which to build the rest of your life.I guess, apart from the academic side, it would also be life skills that you learn while at university and on campus and going out while you're at university. So, yes, friendships and experiences. But then, obviously, on the academic side, you've got knowledge and skills like critical thinking and studiousness. I don't know if that's the word. But you know what I'm talking about. So, yes, those. - Year 7

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Having a degree brings a sense of personal fulfillment…

Using their degrees to educate others,

Being able to work hard at their jobs and being taken seriously,

Completing the degree demonstrated they overcame their fear of "studying a really hard subject",

Feeling like they can now make any career move.

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Having a degree brings a sense of personal fulfillment…

Denise, graduated from Erbium, Quality Control Analyst

Yes, because the main thing was just getting a degree. I mean, I sort of went in with a one-track mind- you know, if I had been younger, it might have been good to make friends, meet people and all this, but they don't have all these life experiences in two societies or anything like that, but for me it was literally, "I wasn't to go and get a degree," and that is what I did. - Year 6

Conclusions from Chemistry data

A holistic view of how they have been using and can further use their knowledge,

Assuming a more active role in what they learn and skills they have developed beyond their degrees,

Most graduates described a personal gains from pursuing their degrees with explicit discussions of prioritising self care,

A few graduates mentioned being able to make a positive contribution to the world around them,

Generally, discussions centred around what happens next.

Lessons learned

More intentional connections between degree programmes and societal roles/purpose of degrees,

Defining the scope and meaning of social responsibility,

How do we assist students and practitioners in developing an awareness of broader landscape in which higher education is situated?

Importance of ethics education

Is it even reasonable to expect to see a major shift toward societal orientation three years after completing a degree?

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