CENTRE FOR GLOBAL HIGHER EDUCATION

How STEM graduates reflect on the knowledge they gained from their university degrees

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14th March 2024

Insights from the two projects:

Understanding Student Knowledge and Agency

Graduate Experiences of Employability and Knowledge

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Agenda for today….

Connecting knowledge with the degree programs' intentions (Tuesday)

Where did students land up?

How are they using knowledge from their degrees?

What worldview do they hold?

How do they solve problems?

Overall transformations through engagement with knowledge

Tuesday….

Chemistry departments all focused on giving a solid foundation.

Noting problem solving skills

Breadth of offering

Central science

Europium – specific focus on analytical chemistry

Samarium – beauty of chemistry

Where are the chemists at year 7?

Institution	MSc/ PhD	Quality control	Lab tech	Teaching	Working out of chem	Other degree
Erbium	2	3	1	2	1	
Europium	2	2	2	1	3	
Sodium	3	1		2		
Samarium	1				2	2

- 22 out of 30 have jobs that directly draw on their training
- 1 SA v 8 English have lab based jobs
- Students from all programs have continued to further study in chemistry

Tuesday….

Chem Eng departments had different approaches

Erbium – focus on sustainability

Europium –focus on strong chemistry

Samarium – focus on environmental issues

Sodium – focus on problem solving in engineering

Chem Eng: Where are they at year 7?

Institution	MSc/ PhD	engineer	Health and safety	Lab work	Financial/ data	Other work/ degree	unemployed
Erbium	2	2	2		3		
Europium			1	1	1	2	1
Sodium	1	1				4	
Samarium						4	1

- 3 working as chemical engineers
- 11/26 potentially drawing on content from their degrees

Many students choose chem eng over chemistry because it has a defined career path

Using their knowledge (chemistry)

Hayley (Europium) working in a research lab - developing a method, testing products, understanding chemicals and instruments and that all, kind of, is from chemistry

Simon (Sodium) doing a PhD – UG gives foundational knowledge which is assumed at PG level

Damien (Erbium) working in DNA lab – does 'chemistry in disguise' – understands the underlying principles and uses lab skills and techniques

Using their knowledge (engineering)

Rubiya (Europium) – “I think the main thing that’s very relevant is sustainability, because the department that I’m in right now, their main focus is sustainability and working towards a net-zero goal. Basically developing options for different type of net-zero goals and a lot of that is what I did in chemical engineering. And I think just computing skills, I would say, they’ve really come in useful.”

Using their knowledge (engineering)

Nisha (Europium) – “My background is in chemical engineering, and I think there are certain gaps between a chemical engineering undergrad degree and shifting focus to a business, a corporate financial environment…. But what I think is pretty similar is from Chem Eng we are very used to looking at systems and processes. Obviously, more technical in nature. I think it is just being able to get a bird’s-eye of view what goes on, and also understand the detail of what is happening, why it is happening and optimising for efficiency.”

Using their knowledge (engineering)

Leon (Erbium) – ‘Right now, I don’t necessarily have to every day make use of my degree. I guess your degree is more than just your degree sometimes. It’s all the other skills that you pick up, your teamworking and skills like that’

View of the world

Ashwin (2020) argues that there are no generic skills.

The ‘transformative’ part of higher education comes through emersion in a specific discipline

View of the world

Chemists…
Molecular view of the world…
‘Fine grained’
‘Individual parts’
‘Below the surface’

Engineers…
Process view of the world…
‘efficiency’
‘sustainability’
‘cost effectiveness’

Donna (Erbium) – Data solutions architect - chemist

'I would describe chemistry as the make-up of things at the finest level of grain and detail, down to the very particles that make everything that we know. It is about that, but it is also about the interactions that they have because- Similar to cooking. You can have the exact same ingredients, but if you cook them in different ways, so the order of which you add things, or if you use different temperatures to cook them at, the way that each individual ingredient is prepared, you could have two very different dishes, even if they have the exact same ingredients. I would say that is an analogy for chemistry. In the sense that you can have two things made out of exactly the same thing, but if the way that it has been structured and put together is different, or it has undergone a different process, those two things can be very different'

Muhammed (Samarium) MSc - chemist

If we think about canned food, canned food has to contain a sort of liquid that preserves the food. Now, what substances are in that liquid, so that it helps preserve that food? That's a question for a chemist to answer.

Harry (Europium) National Nuclear Lab – chemist

‘It’s just the way the world works, really, in the broadest, most simple, of terms. if I’m doing a bit of DIY around the house, I might think about the hazards involved.’

Tanika (Sodium) MEng –

If you start using the words ‘optimising’ and ‘efficiency’ in a normal sentence, people will look at you like you’re whack or something" but it's "really like an unconscious kind of application"- she understands how a bike works, heat transfer in cooking and thinking about problems, solutions, advantages and disadvantage

Nisha (Samarius) – Junior Project Engineer

"Instead of how I get there, is, "How can I get there in the most efficient and cost effective manner possible?" When you are building a chemical plant it can be very easy to say, "Okay. This is my process. I need to strip out four different components. Let's have distillation column one, distillation column two, three, four. We have got our end state." Whereas if you do your proper research you can find out, "Okay, under these specific conditions, pressure, temperature, maybe we can condense certain components, we can vaporise other components, and then we can still separate out the one output that we need. Whereas we just use one unit. That is less capital cost, less operational cost, fewer safety implications,"

Lawrence (Erbium)
Energy safety consultant - engineer

I think that has changed my perspective on things- a better understanding of supply chain shortages. Logical, thorough and based on feasibility

Problem solving…

Both chemists and engineers break it down into steps

Engineers

Tammy (Sodium): Break it down into smaller steps

Tracy (Sodium): Break down the problem into small achievable tasks

Chemists

Mason (Samarium): it's the desire to understanding and breaking down complex concepts

Only the engineers mentioned reinsertion into the whole

Leon (Erbium): breaking things down and then building it up to the bigger picture

What else have they gained…

Damien (Erbium) Of all the sciences chemistry is one of the most diverse and interdisciplinary

Hayden (Europium) - the tools to pursue education in his own free time without guidance

Samantha (Sodium) - ability to study something abstract, the understanding of the world and the chemistry behind everyday life and things

Connection to the intended focus of the curricula (engineering)

Erbium – Leanne – ‘mainly around things like the energy issues that are going on, environmental, climate change, all that kind of stuff.’

Samarium – Nevin – efficiency, sustainability and problem solving and not impact negatively on the environment

There is remarkably little connection to the particular intentions of the departments

Key takeaways

These degrees are shaping their way of being in the world.

There is overlap and distinction between the chemists and the engineers

The specific focus of the engineering courses is not as evident as the intended curricula suggest

Remaining questions…

Persistence of narrative around jobs