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Doing chemistry and chemical engineering

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Outline

- About the project and its methodology (*Understanding Knowledge, Curriculum and Student Agency (UK-SA) in Chemistry and Chemical Engineering*')
- Paul: students' relations to knowledge
- Jan: role of assessment in how students engage with knowledge
- Janja: students' relations to employability
- Conclusion: future work on the project

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UK-SA project

- As HE participation has increased, there has been an increased focus on STEM programmes in relation to both economic development and individual prosperity;
- There is less understanding of the transformational impact of these disciplines in terms of the ways in which they transform students' sense of identity by engaging them with disciplinary knowledge.
- Research into these forms of transformation have tended to focus on subjects and disciplines that are 'soft' rather than 'hard' and/or concerned with 'life systems' rather than 'non-life systems', (Becher's 1973)
- Also tend to focus on curricula within single national contexts and not provided an examination of whether relations between knowledge, pedagogy and student identity vary between national contexts (Ashwin et al 2014).
- For these reasons examining Chemistry and Chemical Engineering in the UK and South Africa

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Methodology

- Basic methodological information:
  - Longitudinal study (from October 2016 to July 2020)
  - Multiple sites (UK, SA, 8 departments)
  - Comparative study (disciplines, countries, ?)
  - Rich data

- Specifically, the collected data will include
  - interviews with selected students once per year (altogether 400 interviews); video recordings of selected classes and interviews with the people leading the classes (altogether 28 sessions and 28 interviews); class survey at the final year of the programme (up to 800 students); curriculum documentation, including programme and module handbooks; examples of students' assessed assignments; publicly available students' association documents where existing; institutional policy documents; national policy documents; disciplinary bodies' policy documents.

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Today

- Preliminary!

- Interim results:

only 1st year

only UK

only student interviews

	Chemistry	Chemical Engineering	All
UNI1	14 (9BSc, 5MSc) (9 Female, 5 Male)	16 (9BEng, 7MEng) (1 Female, 15 Male)	30 (9B, 5M) (10 Female, 20 Male)
UNI2	17 (5BSc, 12MSc) (6 Female, 11 Male)	19 (14BEng, 5MEng) (10 Female, 9 Male)	36 (19B, 17M) (16 Female, 20 Male)
All	**31** (9BSc, 5MSc) (15 Female, 16 Male)	**35** (9BEng, 5MEng) (11 Female, 24 Male)	**66** **(37B, 29M)** (26 Female, 40 Male)

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STUDENTS' RELATIONS TO KNOWLEDGE

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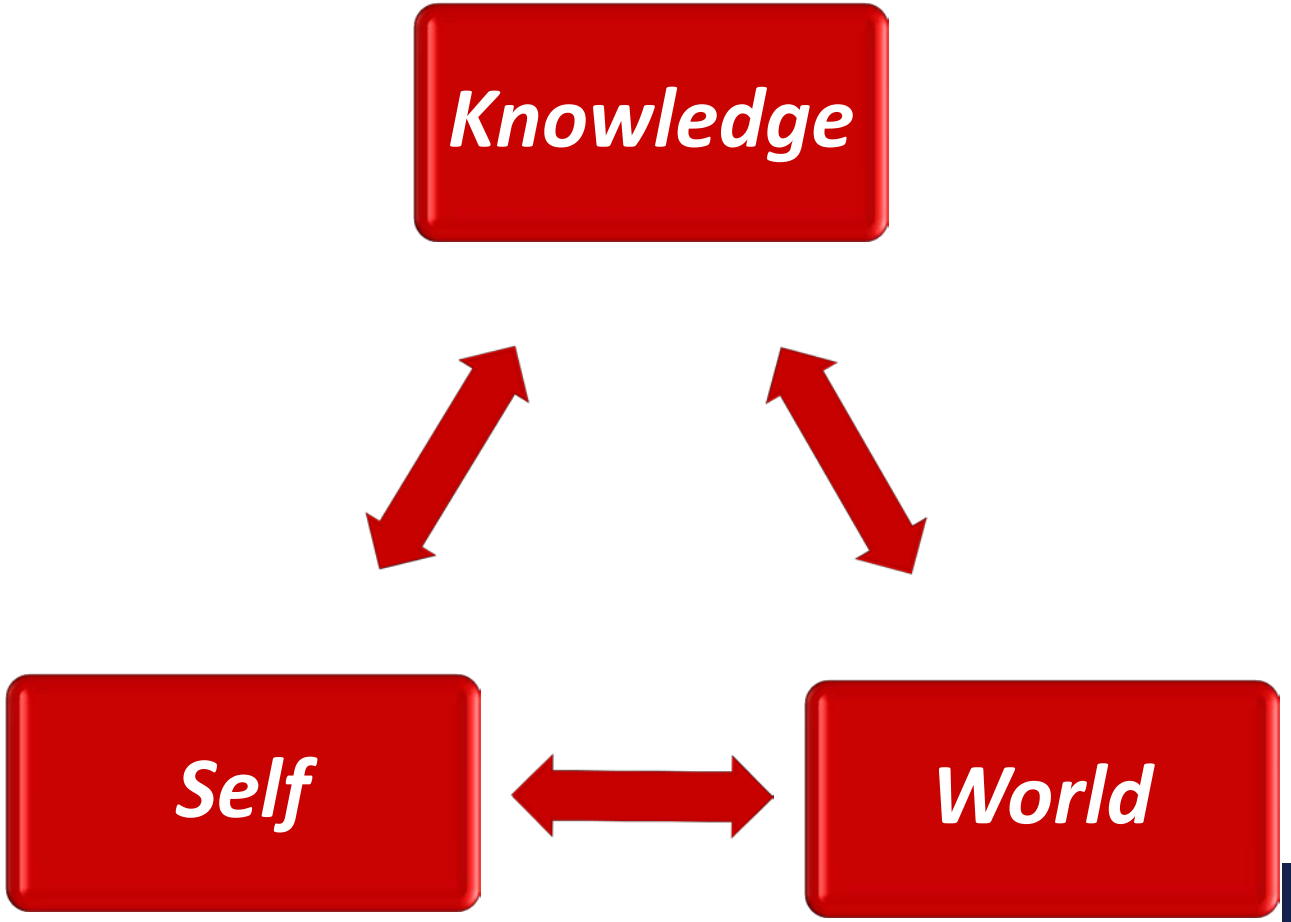
Students' relations to knowledge



Discipline	Studies	Least inclusive Account	'Watershed' account	Most Inclusive account
Accountancy	Sin et al. 2012	Routine work	Meaningful work	Moral work
Geography	Bradbeer et al. 2004	General world	Structured into parts	Interactions
Geoscience	Stokes 2011	Composition of earth	Interacting systems	Relations earth and society
Law	Reid et al. 2006	Content	System	Extension of self
Music	Reid 2001	Instrument	Meaning	Communicating
Mathematics	Wood et al. 2012	Numbers	Models	Approach to life
Sociology	Ashwin et al. 2014	Developing opinions	Study of Society	Relations people and societies

Accounts of Chemistry

1. Chemistry is about making and discovering chemicals;
2. Chemistry is the study of what makes up the world;
3. Chemistry is the study of how things change;
4. Chemistry is the study of interactions at a molecular and at an atomic level

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Chemistry is about making and discovering chemicals

The discovering of new chemicals, new formulae to benefit the world as a whole. You find new catalysts, like palladium catalysts, and using them in car exhausts to filter out the emissions, make it more green… finding these new compounds which could help the world as a whole to grow and expand and improve.

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Chemistry is the study of interactions at a molecular and at an atomic level

I'd say it's divided into three sort of main themes, so there's physical, inorganic and organic. And I'd probably divide it into those three.

Physical is a bit more like Physics, a bit more related to the fundamental ideas of how just matter or measuring energy and all the physical properties, that's what that is.

Organic Chemistry is more about reactions and the structure of molecules, how they interact. So that's that and then there's inorganic, which is the way you broadly think of Chemistry, with the chemistry of the elements, you know, why a certain chemical's got this colour, "How does this react, if you put this with this?"

In general, it's really sort of looking at atoms and molecules and the properties and how they interact with each other

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Accounts of Chemical Engineering

1. Chemical Engineering is the study of how things are made;
2. Chemical Engineering is the study of problem solving;
3. Chemical Engineering is the designing of production process based on chemical knowledge;
4. Chemical Engineering is the study of how to produce and handle chemicals efficiently (and sustainably) at scale.

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Chemical Engineering is the study of how things are made

I think the way something works or is put together or made. There are many processes to something. You wouldn't think about it but there is, and how something is created and chemically how it's created rather than just biologically.

It's everything together, in that there's maths involved and there's chemistry involved and there's physics involved. It's just how something is made.

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Chemical Engineering is the study of how to produce and handle chemicals efficiently (and sustainably) at scale.

Chemical engineering is… This is actually a hard question. I've been into this for six or seven months now and it's really still hard to explain what chemical engineering is. It is basically the way I would put is making, say scientists they made something, they designed something. It is our job to make it into a large scale production. … It is our job to make it into a large scale production and making it feasible and making it sustainable to the environment.

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ASSESSMENT AND STUDENT ENGAGEMENT WITH KNOWLEDGE

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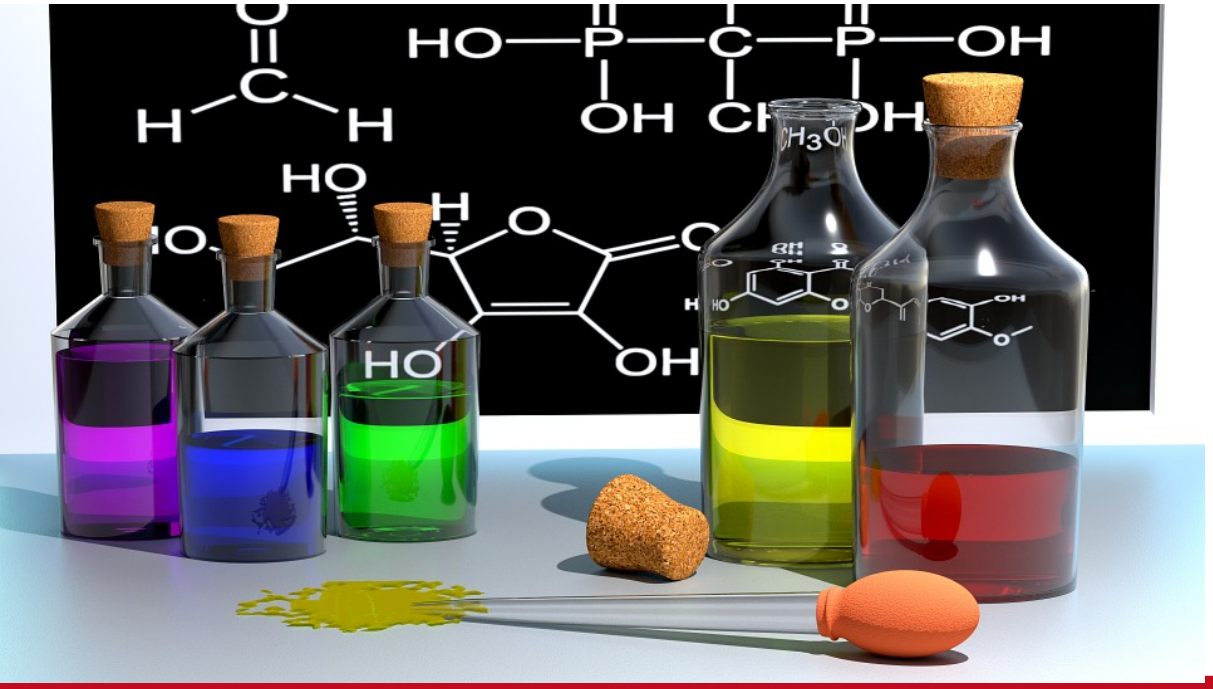
Purposes of assessment

Schatzki's teleoaffective structures

Along with practical understandings, rules, general understandings (1996, 2002)

➔Shape practices



Assessment for learning

Past or future

Active or passive

Related, or not, to discipline/profession

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'…while I hate to admit that I need the skills of an essay, I do know that I do need that sort of skill and I do need to be able to write and explain myself clearly in words, like on paper as well' (U1-C-13)

'The exams and tests are pretty much the same, aside from Physiology where you have to be a bit more wordy' (U2 -C-16)

Lab reports

MCQs

Small tests

Large exams

Peter Knight (2000) – high-stakes and low-stakes assessment

BACK – checking up, compliance

‘I mean obviously it’s to check you’re paying attention and stuff’ (U2 –C-27)

‘I would say it is probably just to make sure first of all everybody is keeping up with the topics’ (U2-C-8)

‘I guess it tests your memory sometimes which is bad but I guess that’s why they do exams at the end of the year’ (U1-E-17)

FUTURE – learn, improve, gain skills and knowledge

‘…it keeps all the knowledge rolling’ (U2-C-19)

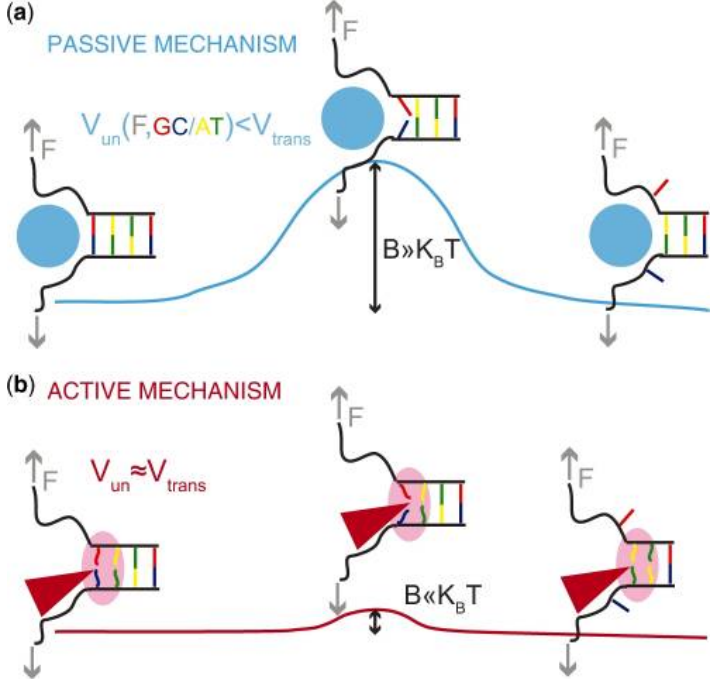
‘…to push our knowledge’ (U1-E-15)

‘It sort of gives you a chance to learn on your own…it gives you the chance to reflect on what you’ve learned and learn something new’ (U2-E-15)

ACTIVE – agency

'…it keeps you on your toes all the time….I do love that, because it helps me develop myself a lot' (U2-C-30)

'For me, it will be a way of enhancing yourself, an assessment puts you in a position where you can feel "Okay, fine am I doing okay or do I need to read more books or do I need to do….?"… So I do love assessment to be honest' (U2-C-30)



PASSIVE – about someone else, out of their control, done to them

'I think we get assessed for the lecturers' (U1-C-29)

'I think it is partially for the lecturers to see if everybody failed you can see that it is the fault of probably the lecturer who didn't explain things properly' (U1-C-13)

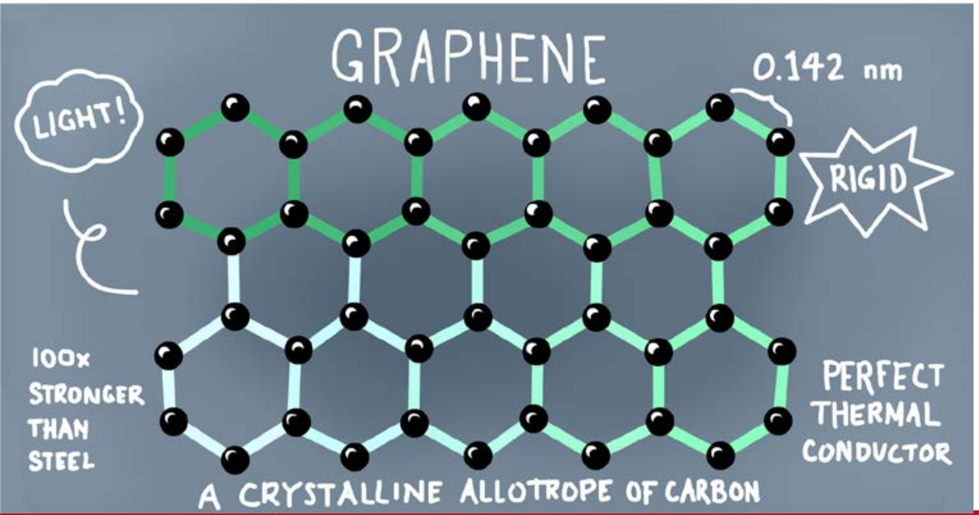
RELATIONSHIP TO DISCIPLINE/PROFESSION

‘…with some of the assessments where you’re using Pro 2 which is where you run simulations and stuff, it’s kind of an indication of what you’ll do in the future’ (U2-E-33)

‘everything that a scientist would have to do’ (U1-C – 6)

‘…because in science people do review your things’ (U2-C-11)

‘…get an insight into how new scientific ideas actually come from’ (U2-C-4)



…it was an end of year exam in science. That’s quite standard (U1-C-)

You need quite rewarding given that it feels more real, like what the actual lecturers do. Obviously when they do their research they do this all the time. I was just like, “Yes, I feel like I’m doing real science” (U1-C-12)

‘I think it’s kind of traditional, in a way, for physical sciences anyway to just do exams’ (U2-C-31)

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GOING TO UNIVERSITY TO GET A JOB? STUDENTS PERCEPTIONS OF EMPLOYABILITY

Janja Komljenovic

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Context - 1

- Knowledge economy
- Multi-actor and multi-level higher education governance
- Increasing marketization of the sector
- Employability high on policy agenda
  - International and national measures (e.g. benchmarking, financing HE based on employability)
  - University measures (e.g. growing alumni and career offices; jobs like employability directors, employers liaisons; teaching employability)
  - Part of the HE market-making (e.g. graduate employability data as HE market information)

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Context - 2

- Assumptions
  - Students' motivation to go to university is primarily utilitarian (to get particular jobs / employability)
  - Students use employability data to decide what and where to study
  - It is the responsibility of universities to cater for graduate employability
  - Students expect universities to cater for their employability

- Research
  - Policy analysis
  - 'Employability skills' in curriculum
  - No/scarce research on 1. structural changes at universities;

  2. students' notions of employability and their expectations

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This research / today

- What role do perceptions of employability play in student decision-making in deciding what and where to study?
- Do students use league tables, rankings, benchmarks and information on employability in their decision-making on where and what to study?
- How students see the university responsibility for employability?

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Employability in decision-making about what and where to study

I wanted to do biomedical science or medical biology, but I was like, "No, I'm going to chemical engineering because there's a lot of money in that." It seems quite like it's got a good scope as well so that's what made me choose it. (U2-E-7)

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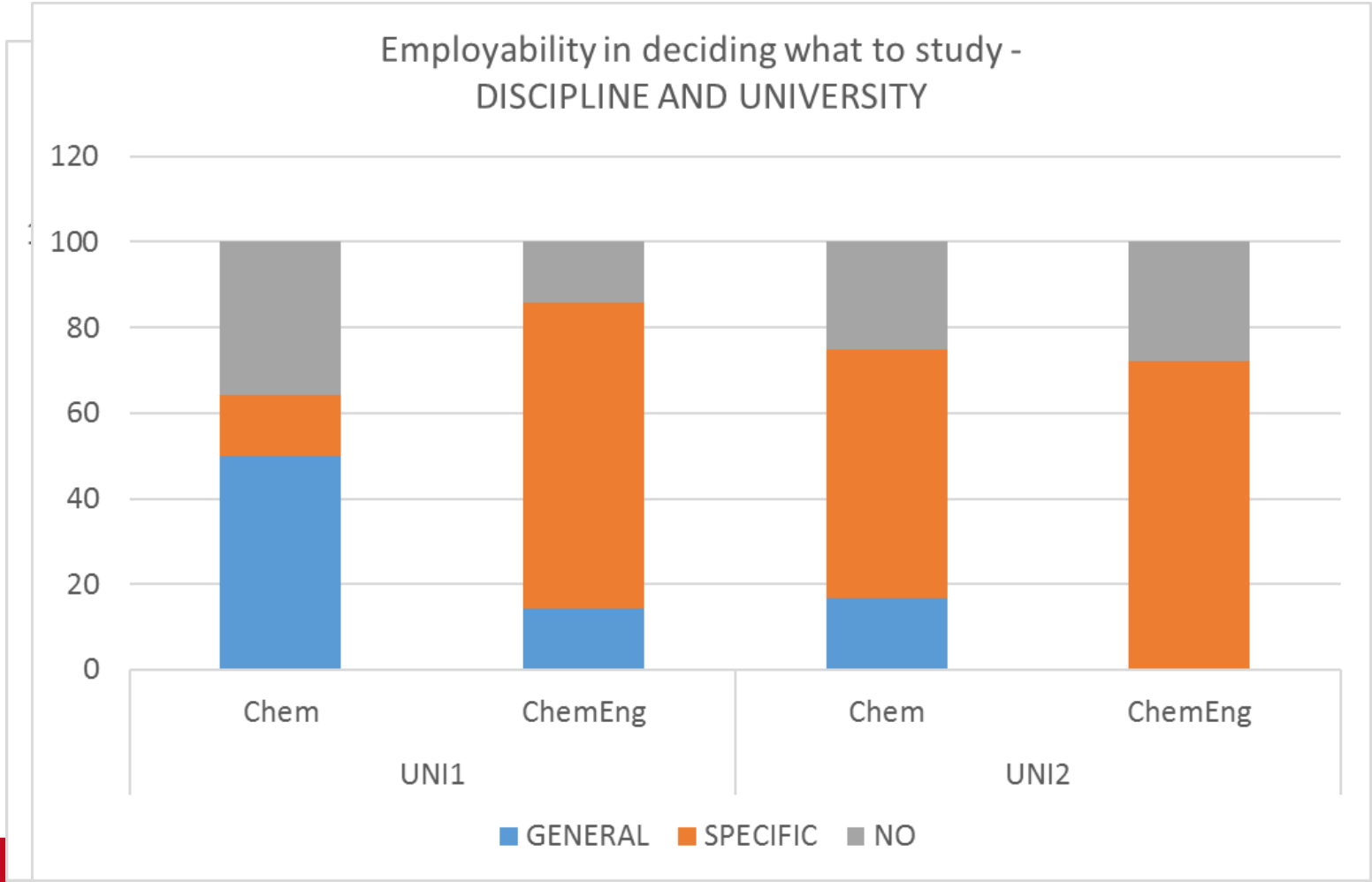
Employability in decision-making about what and where to study

- No difference between:
  - Gender
- Differences between
  - Disciplines
  - Universities



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Looking at rankings and league tables

Yes, so I had a look at the percentage of graduates in managerial positions. I mean, I made sure that all the universities I applied to had high percentages for that. (U1-E-22)

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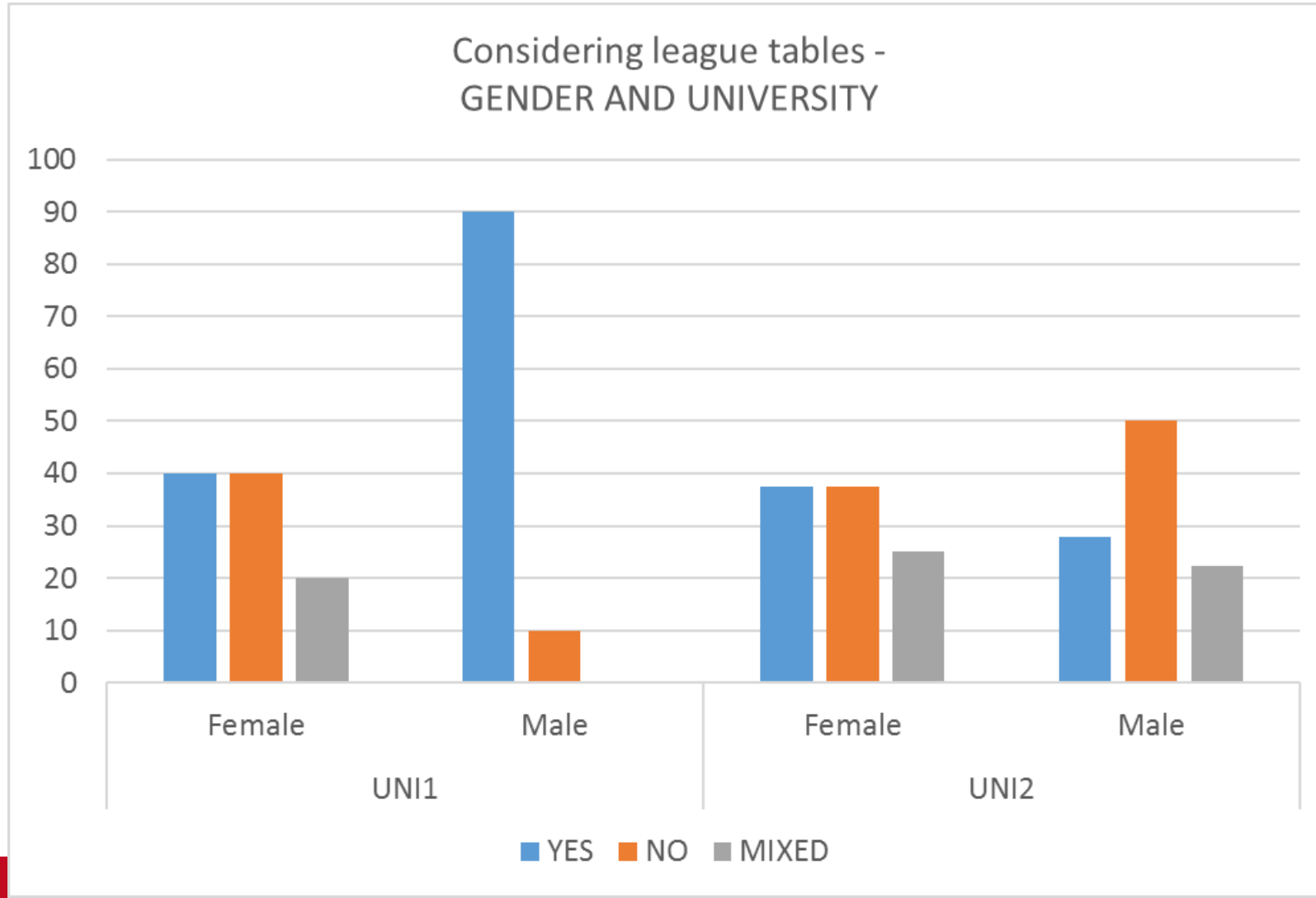
Looking at rankings and league tables

- Differences between
  - Disciplines
  - Universities
  - Gender



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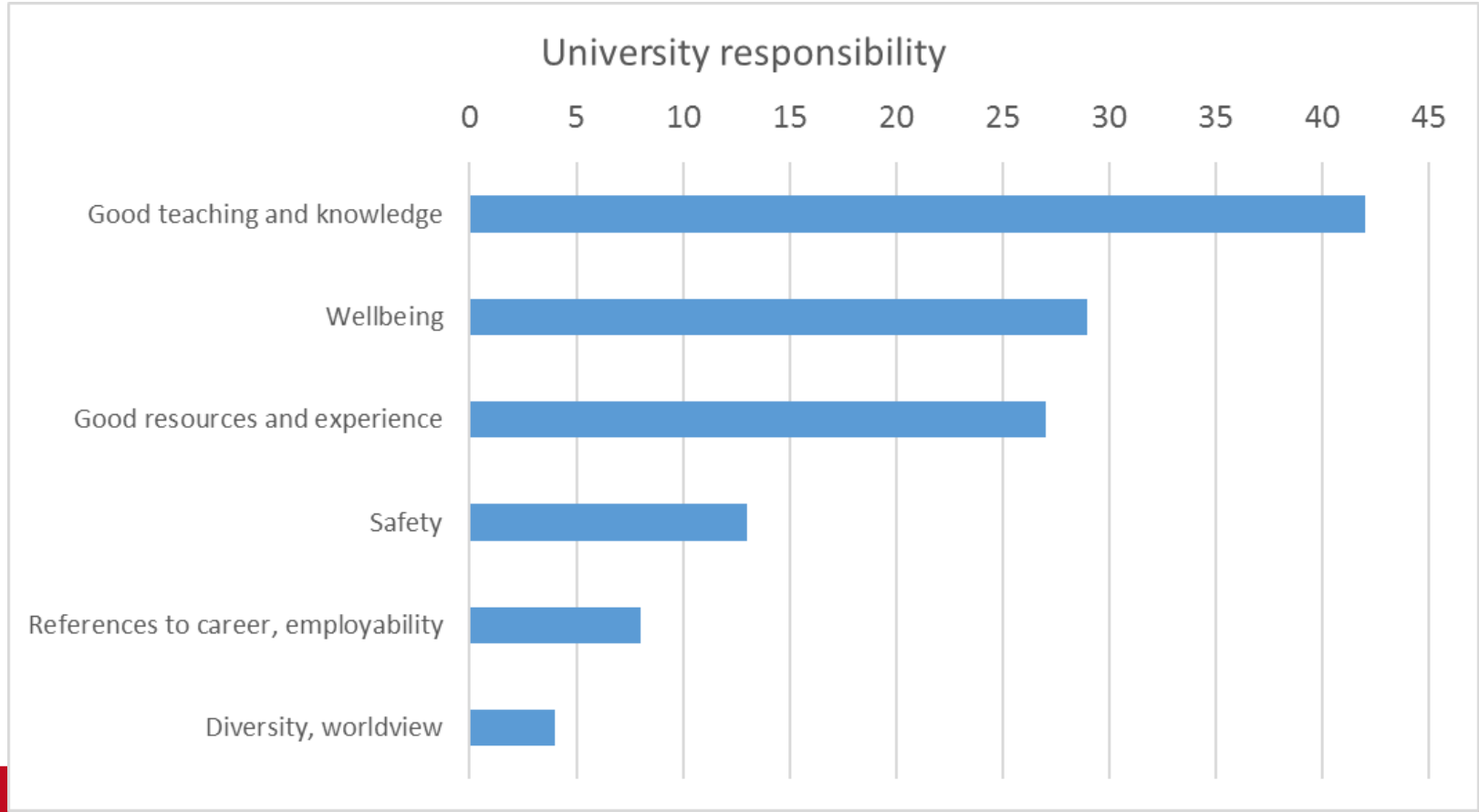
Expectations of the university / university responsibility

- Six main themes

I think the responsibility of the University is to try and do their best to make me employable when I leave here, as well as to keep me having a good lifestyle, with a nice balance of facilities like the gym and stuff like that. I think it's about a balance, really. (U1-E-24)



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Main conclusions

- Students relate to the notion of employability in different ways
  - Differences in discipline and university (student background)
  - Many students seem to learn about employability figures and support after coming to the university (discourse)
    - Who is expecting what?
- Students use league tables and rankings differently
  - Differences in university (student background) and discipline
  - Many students seem to learn about figures when checking university webpages and open days
    - Seems universities are constructing markets around league tables
- Students do not seem to expect universities to be responsible for their employability as straightforward as promoted
  - Generalised notion of benefits of higher education

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PROJECT

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Future plans

- Analyse trends in time
- Add data from South Africa
- Comparative analysis based on number of factors

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THANK YOU FOR YOUR ATTENTION

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