Changing the way we teach using co-creation: Embedding employability in the engineering curriculum through the students' perspective

Routoula, Eleni[a] Halliday, Olivia[a] Zandi, Mohammad[a]

Department of Chemical and Biological Engineering, University of Sheffield, UK [a]

Corresponding Author's Email: e.routoula@sheffield.ac.uk

KEY WORDS: Employability, Student voice, Co-creation, Curriculum

SUMMARY

Student voice is not often included in curriculum design, leading to limited course overview and student engagement. To improve student engagement for the "Skills for Employability" module available in all courses offered at the Department of Chemical & Biological Engineering (CBE) at the University of Sheffield, we designed a student-led research project with three strands. A survey was deployed to academics, students, and alumni, our approach regarding employability was compared to that followed by 29 other universities with relevant courses, and a review of the module content was performed. Findings revealed that academics, students, and alumni are not always on the same page regarding employability or teaching practices. This project has shown that we need to actively listen to the student voice, encourage students to shape aspects of the module, and support them in understanding the link between their course and employability alongside outlining that employability skills are just as or more important as the technical skills they hold. This paper shows the approach we followed, highlights findings through all three project strands, and indicates steps, mainly proposed by students, as best practice to improve engagement and takeaways.

INTRODUCTION

Graduate employability is a priority in Higher Education, with many universities offering tailored support and having integrated the provision of opportunities for students to develop employability skills through the engineering curriculum (Winberg, 2020). There is a lot of attention paid in active learning through project/problem/work-based learning opportunities through the curriculum (Hernández-de-Menéndez, 2019) and how such opportunities help students develop their employability (Little, 2016), both from an educational point of view and the employers' perspective. However, when it comes to student engagement with employability-related resources, it is fair to characterise it as "limited" (Powell, 2022 & Routoula, 2023a).

CONTEXT: THE ENGINEERING EDUCATION PROBLEM AND INTERVENTION

While redesigning the CBE Undergraduate Curriculum in 2017, a key priority was to empower our graduates to hit the ground running, hence we introduced a "Skills for Employability" module across Year 1-3 of all courses (Zandi, 2017). Since 2017, the module has gotten at a stage today where it has clear focus for each year of study (skills, experience, preparation for practice) and offers reflective assignments on students' interests, developmental needs, and growth. Throughout their studies students have access to support (applications, interviews), networking opportunities with alumni and employers (dedicated conference) and feedback derived from real-world graduate recruitment requirements (Routoula, 2023b).

Given the "soft" nature of the "Skills for Employability" module across a very technical curriculum, it has limited student engagement and is regarded as disjointed and standalone rather than integrated in the curriculum alongside technical material. Existing literature has pointed possible elements for improvement when it comes to embedding employability in existing modules (Bradley, 2021), or improving available employability support at course (Dr Rodanas Valero, 2020) or institutional level (Staunton, 2021). This has sparked the need for research on how to improve student engagement and module integration. In order to get the most benefits for the students out of this project and include the student voice in curriculum design, we decided that it was best for a current student to spearhead this work (Folta, 1974).

DESCRIPTION OF INTERVENTION / PRACTICE

This project followed a three-legged approach, incorporating internal and external aspects, to understand how the "Skills for Employability" module is currently viewed by stakeholders, and what can we do to improve student engagement and integration.

Part 1: A survey was deployed to three bodies (staff, students of all cohorts, recent alumni). The questions consisted of quantitative and qualitative, open and closed, on aspects around employability and the module (Table 1).

Table 1. Sample of questions deployed to students, academics, and alumni, during the undergraduate summer research project

Examples of questions deployed to two or more bodies
How important do you think "Skills for Employability" is at the 1st year of study? (multiple choice)
How important do you think a skills audit is at the 1st year of study? (multiple choice)
Do you think it would be more beneficial to embed skills for employability within selected modules in each year group rather than having a separate module? (multiple choice)
Out of the following employability related areas and skills, select the three statements which reflect the areas you lack confidence at. (drop down list)
Question on contact time and assessment type (multiple choice)

Part 2: The existing module content (syllabus, activities) was reviewed from a student's perspective, in order to receive feedback on improvements that could improve the engagement with the module.

Part 3: The employability support offered by other Universities offering chemical engineering courses was compared using five criteria: a) existence of standalone employability-related module, b) obvious integration of employability, c) presence of employability-focused staff in the department, d) targeted career-related events, and e) strong career service. In total we reviewed 19 institutions in the UK and 10 international institutions.

EVALUATION OF INTERVENTION / PRACTICE

RESULTS FOR PART 1: SURVEY

Based on the answers as shown in Figure 1, staff see employability provision as much more important at early stages compared to students or alumni. Moving to the importance of a skills audit early on in the degree (Figure 2), results show that alumni value that much higher compared to current students, possibly recognising the importance of being aware of your skills.

Figure 1. Answers of students (left, 36 respondents), staff (centre, 13 respondents) and alumni (right, 22 respondents) on the importance of the "Skills for Employability" module for students at their 1st year of study

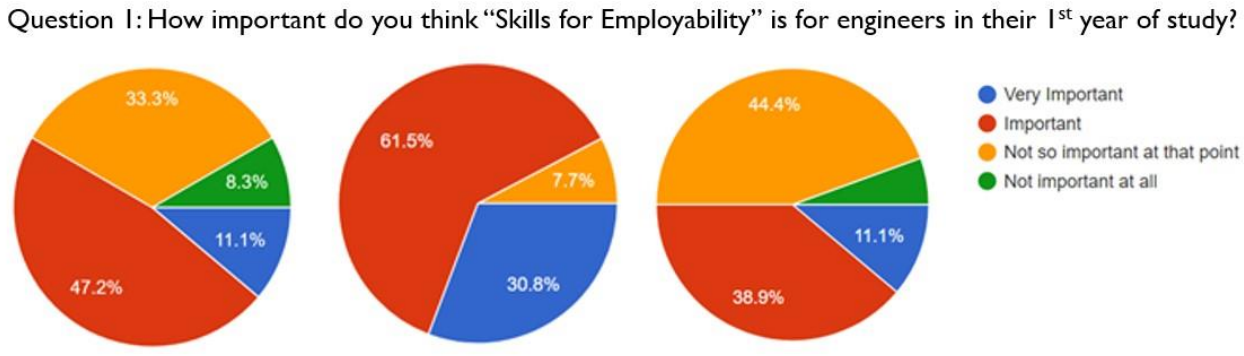
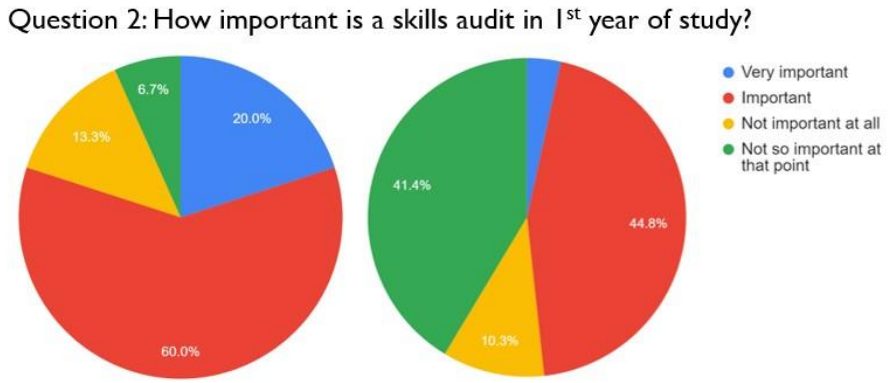
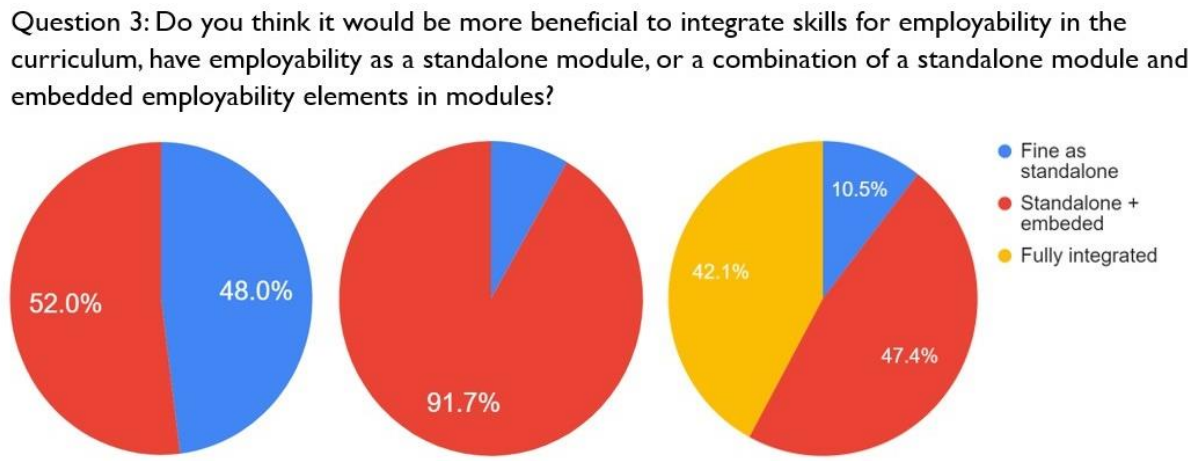


Figure 2. Answers of students (left, 36 respondents) and alumni (right, 22 respondents) on the importance of a skills audit during the 1st year of studies



When asked about having a standalone employability-related module or not (Figure 3), staff and students voted for maintaining a standalone module but also having elements embedded in other modules in the curriculum, whereas alumni was the only body proposing to do away with the module and fully integrate employability in the curriculum.

Figure 3. Answers of students (left, 36 respondents), staff (centre, 13 respondents) and alumni (right, 22 respondents) on whether employability should be offered as a standalone module, be fully integrated in the curriculum, or be offered as a standalone and have embedded elements in other modules



When asked about content and contact time, alumni indicated that more elements should be added to enrich the content of the module, staff and students agreed that having a different focus every year has a positive effect, and only staff proposed increasing the contact hour. When asked about assessment, all bodies pointed that self-reflection and job application elements should be present in the assessment for all years.

Regarding the top three skills students are struggling the most with, responses from staff and students were different, at a first glance (Table 2), with students pointing out networking as their top priority and staff picking (technical) writing skills as the stickiest point. Analysing the responses further, it is obvious that students focus more on "out-facing" skills such as networking and interview skills, whereas staff focus on fundamental skills such as writing and critical thinking. An underlying theme for both sides is communication (networking, interviews, writing skills) and another theme is putting the degree into perspective (real life work experience, wider context, connection to real life).

Table 2. Responses from students and staff on skills students struggle the most with (drop-down list)

Skill	**Students**	**Staff**

#1	Networking	Technical writing skills
#2	Exposure to real life work experiences	Professional skills (& Understanding the wider context of the degree)
#3	Interview skills	Critical thinking (& Connection of education to real-life)

In an open ended question about further thoughts relevant to employability and the module, staff, students, and alumni submitted ideas, consideration, comments that offer a great basis for improvements. Some of them are shown in Table 3 below.

Table 3. Selected comments from staff, students and alumni with regards to employability provision and the "Skills for Employability" module

Staff	**Students**	**Alumni**
A degree does not equal a job!	If possible the module to have a small credit and not just be pass/fail. This would motivate students to spend more time on employability activities.	Integrate industry examples within each of the course modules or ask industrialists to deliver course content, to better allow students to understand where the content they are being taught could be relevant in the real world.
Interactive tutorials, increased compulsory attendance, quizzes, easy access to training, connection of studies to professional expectations, focus groups with engaged students...	Very difficult to make the module work for everyone. The current format works for those who want to get a lot out of it as they can but it also allows for people to just coast along if they aren't as interested.	More links to people's "personal experience". However my thoughts are that you can only do so much - a lot of the 'employability' stuff needs you to show proactivity and self-motivation, which are very difficult to teach via a mandatory module.

Need to improve the links between students/employers and students/real life application.	Have more group sessions where we can practice our interview skills etc but also have them within other modules too to make it more engaging.	More opportunities for students to learn about unconventional career paths + smarter links between other modules and employability.

RESULTS FOR PART 2: MODULE CONTENT REVIEW

Content was reviewed by the student researcher, to capture the student perspective. At the point of review, the available module content was as seen in Table 4. The review revealed that there is room for improvement, for example by slight tweaks in the available content per year of study or enrichment of the assessment (Table 5).

Table 4. Current (at the point of review) module content for "Skills for Employability" per year of study

Year of study	**1**	**2**	**3***
Module Content	Introduction of employability and its importance, transferable skills / development, practice CV and Cover Letter writing.	Recruitment processes, communication, writing successful applications, how to tailor oneself using a job description, discussion of the range of career options, opportunities for further experience.	How to network, examples of CV/Cover Letter and interview skills/practice, explain parts of an application process.
Assessment	Submission of a CV and Cover Letter tailored to a specific job application, including creating a LinkedIn profile and auditing skills using MySkills.	Reflective assignment (based on Career & Employability conference sessions and combined reflection on personal development and career/future plan).	

Contact time	Three tutorials per semester, compulsory to attend at least one tutorial per semester and submit/pass the assignment. * "Skills for Employability" in Year 3 runs only for the Autumn semester.
Additional resources	CBE organises an annual Career and Employability Conference, tailored to chemical engineers, available for all students at all levels.

Table 5. Proposed changes to module content and assessment per year of study

Year	**1**	**2**	**3**
Module Content	Students should become aware of what chemical engineering entails earlier in their studies.	Include CV/cover letter work, more explicit information on course options (year in industry, MEng…) and summer placements.	N/A
Assessment	Make conference attendance compulsory for Year 1 students as well (one session of their choice).	Introduce application writing in the assessment, similar to Year 1.	Review of skills development, introduction of compulsory 1-1 meeting with employability - related staff.
Further suggestions	More interactive tutorials rather than "lecture" style, potentially smaller group sessions rather than cohort-wide to increase engagement.		

RESULTS FOR PART 3: COMPARISON OF PRACTICE FOLLOWED BY OTHER UNIVERSITIES

We reviewed 29 Universities offering chemical engineering courses using the five criteria described in out methodology. Findings are presented in Table 6.

Table 6.Comparison of practice across different Universities offering chemical engineering courses

Criterion	Finding	Comparison to TUoS / CBE practice
Standalone employability module	16% Universities	Yes
Obvious employability integration	62% Universities	Yes
Employability-focused staff	47% Universities (100% of those offering standalone module)	Yes
Targeted career events	100% Universities, in many occasions there are events targeting specific departments	Yes
Strong career service	100% Universities	Yes (central service, faculty-specific teams, dedicated staff in most departments)

These findings illustrate that the employability-related practice followed at CBE in the University of Sheffield is stronger compared to competitors. Whereas all Universities offer career support at institutional level and in many cases the curricula have integrated employability elements in teaching, it is not often to see a dedicated module to employability or a dedicated member of staff.

EVALUATION OF OUTCOMES

Based on the collected data from the three parts of this project, we decided on immediate actions to take forward (applied in the year 2022-2023), and actions that we would take forward in the near future. The immediate and longer-term actions are shown in Table 7.

Table 7. Actions that were proposed and introduced as a result from this research project

Immediate actions (applied in 2022-2023)	**Long-term actions**
Enrich Year 2 & 3 assessment with partial application submission	Split cohorts in smaller groups

Increased interactive sessions	Increase invited speakers during tutorials
Increase available content (and contact time)	Increase employer sessions outside conference span
Introduced mapping activity of skills/experience across the curriculum	Embed employability in other modules (already underway)
Introduced mock-interview panel activity	
Introduced weekly targeted newsletter	

DISCUSSION

Given the nature of the project (input to influence changes in ongoing modules/practice) a formal evaluation of the impact of the project is not available yet, despite completed data collection and an initial evaluation. Feedback through standard student evaluation surveys conducted institutionally over the past year, where the "immediate actions" shown in Table 7 were implemented, illustrates that students in the 2nd and 3rd year of study appreciate the enriched assessment and found some of the newly introduced activities (design of a personal development plan, mock interview panel activity, weekly newsletter) useful.

In terms of data collection through the survey, responses received (around 10% respondents per student cohort, 30% of staff) pose a representative image of the department. The survey was deployed over the summer break, justifying the lower student participation, but student responses were distributed equally across the year groups. The model of surveying students, staff and alumni (possible employers) has been seen before (Staunton, 2021), and was chosen to collect views from all stakeholders contributing and affected by student employability. It was interesting and at times eye-opening to receive feedback through the student perspective on specific questions, and see how and where views across the student and staff cohorts differ.

All cohorts indicated the need to preserve the module, but also to better embed employability elements in the curriculum, drawing on the importance of protected time and space for employability provided within the curriculum (Bradley, 2021 & Staunton, 2021). Comments received from all surveyed cohorts (students, staff, alumni) focused on better links with employers and understanding of their needs, point heavily mentioned in other universities' employability strategy (Advance HE, 2020). Furthermore, all cohorts acknowledged students' responsibility to their employability in terms of engagement with provided material and initiatives, and not relying on the degree itself for positive outcomes.

This point has been mentioned elsewhere, starting a conversation about the responsibility each stakeholder (university, students, employers) holds (Sin, 2015 & Cheng, 2021).

Further work would involve more in-depth analysis of the collected comments from all cohorts to identify common themes, and possibly a follow-up with student focus groups to discuss their perspectives on implemented actions and proposed implementations.

CONCLUSIONS & RECOMMENDATIONS

Given the wealth of useful and actionable information received through the survey, it is advised that similar surveys are deployed more often, to capture student perspective, allow students to have a say on the structure/delivery of their course, and identify/bridge the gap between what educators think they deliver and what the students receive.

REFERENCES

Advance HE. (2020). *Embedding employability into the curriculum strategic enhancement programme*. Available at: https://www.advance-he.ac.uk/knowledge-hub/embedding-employability-curriculum-strategic-enhancement-programme (accessed 26 January 2024).

Bradley A. (2021) 'Evaluating the efficacy of embedding employability into a second-year undergraduate module'. *Studies in Higher Education* (47), pp2161-2173, DOI:10.1080/03075079.2021.2020748.

Cheng, M. (2022) 'Employability in higher education: a review of key stakeholders' perspectives'. *Higher Education Evaluation and Development,* (16), pp16-31, DOI: 10.1108/HEED-03-2021-0025.

Folta B. (1974) 'Seven Ways to Involve Students in Curriculum Planning'. *The English Journal* (63), pp.42-45, DOI: 10.2307/813647.

De Rodanas Valero, M. (2020) 'Embedding employability and transferable skills in the curriculum: a practical, multidisciplinary approach'. *Higher Education Pedagogies* (5), pp247-266, DOI: 10.1080/23752696.2020.1816846.

Hernández-de-Menéndez, M. (2019) 'Active learning in engineering education. A review of fundamentals, best practices and experiences.' *International Journal on Interactive Design and Manufacturing,* pp.1-14, DOI: 10.1007/s12008-019-00557-8.

Little, B. (2006). *Employability and work-based learning*. Available at: https://www.qualityresearchinternational.com/esecttools/esectpubs/Employability%20and%20workbased%20learning.pdf (accessed 10 August 2023).

Powell A. (2022). *The opportunities and challenges of student engagement in careers and employability provision*. Available at: https://www.agcas.org.uk/write/MediaUploads/Resources/Research%20and%20knowledge/Symp_22_Student_Engagement_Report_Final.pdf (accessed 10 August 2023).

Routoula, E. (2023a) *Student engagement with employability: reflecting on my experience*. Available at: https://www.advance-he.ac.uk/news-and-views/student-engagement-employability-reflecting-my-experience (accessed 10 August 2023).

Routoula, E. (2023b) 'Putting employability at the heart of the undergraduate curriculum' in S. Norton and M. Romero-Gonzales (eds) *A Case Study Compendium; Contemporary Practices and Initiatives in Employability*. The Higher Education Academy. Available at: https://www.advance-he.ac.uk/knowledge-hub/case-study-compendium-contemporary-practices-and-initiatives-employability (accessed 10 August 2023).

Sin, C. (2015) 'Who is responsible for employability? Student perceptions and practices' *Tertiary Education and Management* (22), pp.65-81, DOI: 10.1080/13583883.2015.1134634.

Staunton, C. (2021) *Embedding Employability Survey Insights from Student, Graduate, Staff and Employer Voice Profiles*. Available at: https://www.dkit.ie/assets/uploads/documents/Careers_Resources/DkIT_Embedding_Employability/DkIT-EE%20Survey%20Report.pdf (Accessed: 26 January 2024).

Winberg, C. (2020) 'Developing employability in engineering education: a systematic review of the literature'. *European Journal of Engineering Education*, 45 (2), pp.165-180, DOI: 10.1080/03043797.2018.1534086.

Zandi, M. (2017) ‘A New Curriculum to Train Chemical Engineers to Solve 21st Century Grand Challenges’, 5*th Annual Symposium of the United Kingdom & Ireland Engineering Education Research Network*, Birmingham, UK, 2017, ISBN 978 1 85449 443 6.