STEERING TOGETHER: STUDENT AND STAFF PERSPECTIVES ON AUTONOMY IN FINAL YEAR PROJECTS

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ABSTRACT

Final year projects (FYPs) form an integral part of most undergraduate engineering degrees, aiming to assess a broad range of skills and qualities, many of which will have been developed as students have progressed through their university journey. While there is a consistent structure of assessment, allocation and delivery, these capstone modules have in-built flexibility. Although many students select their project from a pool developed by academic staff, several institutions offer a self-proposal process whereby students develop their own project. The authors were keen to explore why self-proposal has such a low uptake within their department, and whether this was common across other institutions. This paper offers a broad overview of a research project aiming to gain perspectives from staff and students, employing data analysis, surveys and focus groups. There were notable findings from the study, demonstrating that students who self-propose their project are likely to achieve grades up to 8% above average. Additionally, several key benefits and challenges, identified by students and staff are discussed, with students from different institutions facing similar challenges and barriers to those from the author's institution. The study concludes that increased support for students choosing to self-propose would extremely beneficial, alongside work to mitigate some of the potential issues raised by both staff and students to ensure success. This paper forms the foundation of further publications, which are planned for the near future, offering a more detailed analysis and discussion of the results.

KEYWORDS

PBL, Project Based Learning, Final Year Projects, Student Partnership, Co-Design, Standards: 5, 7, 8, 11

INTRODUCTION

Final Year Projects (FYPs) have been a prominent part of engineering undergraduate degree programmes for well over fifty years (Kolmos, 1996). Typically, an individual major project, coalesces the skills and knowledge developed throughout an engineering degree programme and equips students as they begin their careers. They have long been cited as a key aspect of undergraduate engineering courses (Blicblau, 2004; Hurst et al., 1993; Ku & Goh, 2010; Venturi, 2025), representing the last stage of training before entering the job market (Venturi, 2025). They grant students the opportunity to develop a wide range of competencies including technical, interpersonal, organisational, planning, analytical and risk assessment skills, alongside interprofessional competence and ethical sensitivity (Picard et al., 2022). Although projects provide a multitude of benefits for students, they can prove challenging from an institutional point of view, and many administrative hurdles are associated with facilitation. These include pairing project fields and supervisors with students and ensuring that project scopes and student workloads are fair and equal across cohorts. Assessing projects can also be complex, as it involves ensuring students are credited for their efforts while maintaining assessment integrity and a consistent approach to appraisal.

Within the School of Mechanical and Aerospace Engineering at the authors' institution, students beginning their FYP have a number of options. Most students select their project from a list of projects designed by academic staff with project objectives and descriptions provided to assist students considering projects. Some of these projects are industrially backed, developed in association with an external company, based on a real-world problem. Students rank a number of options in order of their preference, and a minimum-cost maximum-flow algorithm assigns projects to students. In the years 2020-2021, 2021-2022 and 2022-2023, 94%, 97% and 98% of students respectively were allocated a project from their top 6 preferences. Students also have the option to design and propose their own project, but this is a largely underutilised option. Students may also embark on a project aligning with the formula student programme. Between 2020-2024, a total of 11 students chose to propose their own project, with the remaining students selecting from the pre-defined list (approximately 200 students per year). This is despite research suggesting extensive benefits to students and students who self-propose with these students tending to achieve higher grades. This low uptake must be explored, alongside unpacking the benefits for students and staff, and the challenges they encounter throughout. The overarching research question for the study is: How do students and staff perceive the benefits and challenges of final-year projects designed by staff, and what are their views on the potential advantages and drawbacks of student-proposed projects?

METHODOLOGY

Several approaches were employed to begin addressing the research question. Ethical approval was sought from the Faculty Research Ethics Committee to conduct staff and student surveys, student focus groups, and staff workshops. Following approval, invitations to participate in various aspects of the study were distributed by email to staff and students within the Engineering and Physical Sciences Faculty at the author's institution. Participants from other UK institutions were invited through the UK and Ireland Engineering Education Research Network mailing list, alongside contacts of the Author's department. Data analysis was also conducted, utilising FYP data held within the department. Although full data analysis is still underway, this paper will give an overview of some key findings from the various methods, and further publications containing full analysis will follow.

RESULTS AND DISCUSSION

Data analysis

Using data relating to final year projects held by the author's department, analysis was conducted to identify any trends of note. There were several interesting findings, specifically around the correlation of project selection to project outcome. Figure 1 compares both self-proposed projects and formula student-based projects to the overall average project outcome for their respective academic year. The graph clearly shows for both the 2022/2023 and 2023/2024 academic year that students who embark on a project they have proposed themselves, or one related to the formula student programme will attain a project mark up to 8% higher than those who select their project from a list. Formula student project data is highlighted, as students are involved in the developmental process of these projects. It's difficult to conclude whether these higher results occur as a result of students self-proposing, or if the population who chose to self-propose would have attained a high mark regardless. Additionally, as only a small number of students currently self-propose, this data gives only an indication of a trend that requires further measurement, with larger samples of self-proposing students and ongoing annual data being added. Figure 2 compares mean project marks from students enrolled on the Bachelor's (BEng) programme to those on the integrated Master's (MEng) programme. As should be expected, master's students year-on year perform around 10-15% better than bachelors. A mean line for each set of results is also shown and demonstrates little deviation (<2.8%) from the average year on year. Marks for BEng students in 2020-2021 and 2021-2022 are lower (3.2% and 1.0% respectively), likely due to the impact of the Covid-19 pandemic. Both results are provided to show a small sample of the output from the analysis, full analysis and discussion of all aspects of the data is beyond the scope of this paper.

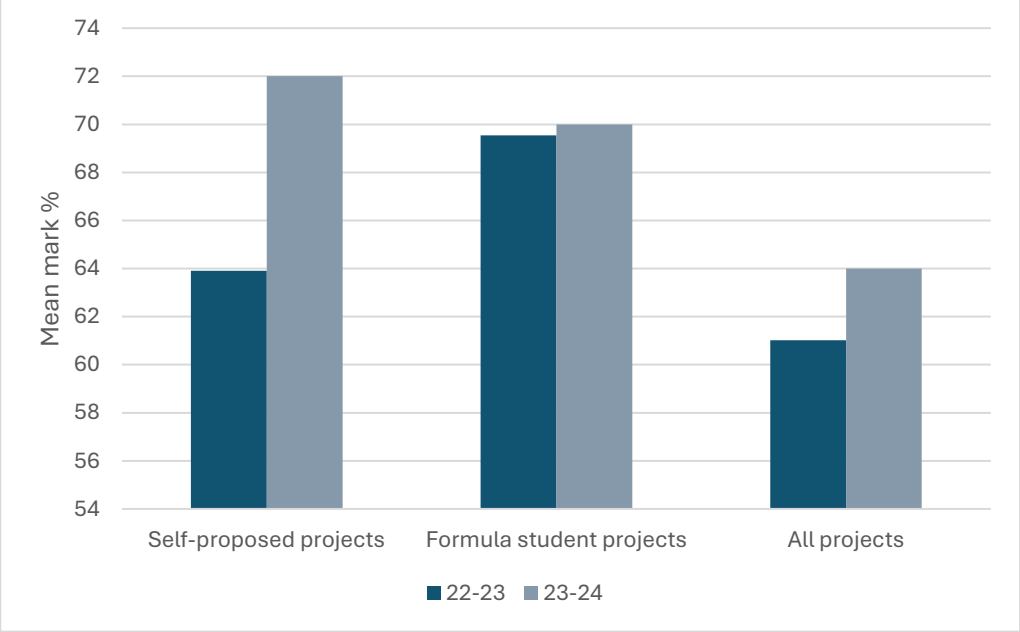

Figure 1: Project selection vs Mean student outcome

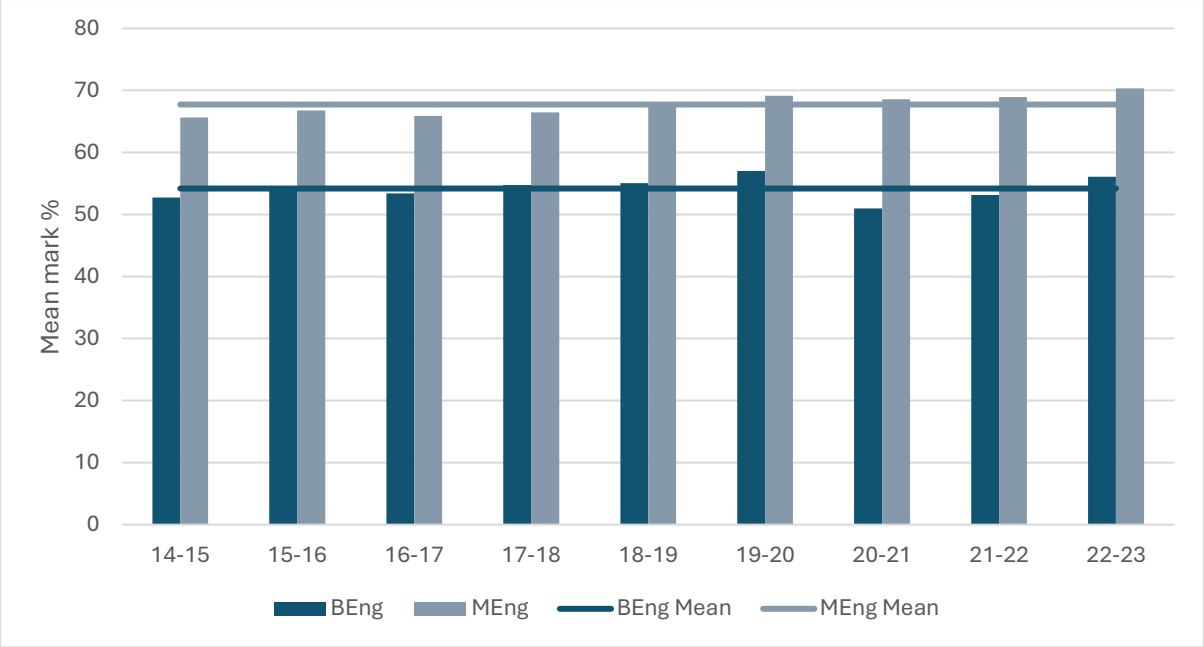

Figure 2: Student pathway vs Mean student outcome

Surveys

Surveys were created to gather preliminary data from staff. The survey gathered data about each participant and their unique perspective. It asked questions relating to FYPs, for example how projects are assessed, the training students are provided with prior to beginning, and how they feel giving students increased freedom within project creation would influence their outcome. 20 responses were received, representing an approximate 27% response from invited participants. Table 1 outlines some key benefits identified by staff in open-ended question responses. For ease, these have been grouped by benefit themes, with direct quotes provided. Figure 3 illustrates the barriers identified by staff, with workloads, time and consistency the most common themes discussed. As before, these results provide a broad overview of some key outcomes from this research package, and a detailed analysis is beyond the scope of this paper.

Table 1: Benefits of introducing more optionality and co-design to Final Year Projects as discussed by staff in surveys

Benefits	Quotations
Higher level of engagement, interest and enthusiasm	“Should theoretically increase engagement with the project, enthusiasm and ownership of the deliverables”
	“Better buy in”
	“Students who are allowed optionality and co-design are more enthusiastic, more interested, and more vested in their project”

	“Students being more engaged and attentive to their final year project, as the determined topic may be of greater interest to them”
	“[More] beneficial/attractive for the students”
	“Engagement and enthusiasm would increase, [Allowing students to display] their potential and understanding more clearly”
	“More engagement from students”
	“Optionality could increase student engagement / motivation.”
Provides students with ownership	“There is also a sense of empowerment by the student. Finally, the projects allow more creativity”
	“Anecdotally, when there is such choice there is also additional ownership, ultimately leading to better outcomes”
	“Self-proposed or co-designed projects may run better if the student believes they have more autonomy.”
More flexibility to choose something they’re interested in	“more options are always better to give the flexibility to the student to choose a project that they interested in”
	“Students can choose the direction/application they are most passionate about”
	“[Allows] students with specific interests and creativity to pursue them”
	“[Allows students to] specialise. Students are given considerable flexibility by each supervisor within the project itself when conducting the research”
	“[There] is certainly some merit to some form of choice- could give some great level of autonomy and might help self-motivate”
Benefits for supervisors	“Meaningful engagement with the supervisor goes up significantly”
	“Take[s] pressure off academics to come up with project titles.”

Figure 3: Barriers of introducing more optionality and co-design to Final Year Projects as discussed by staff in surveys

Focus groups

To gather insight from students, focus groups were selected. Students from the author's faculty were invited to participate, and invitations were distributed to external institutions via contacts of the department. 13 students were recruited, some who self-proposed their project and some who selected their project from a list. The outline was designed using open-ended questions, with the aim of sparking lively discussion within groups. At the beginning of each group, an explanation was given to provide some context and outline some basic guidelines for participation, with an emphasis on the need for confidentiality in line with the ethics protocol and explaining the planned output from the study. Following the introduction, students were asked to introduce themselves, explaining their pathway and engineering discipline before giving an overview of their final year project. 13 students participated in focus groups at which point the research team were satisfied that saturation occurred as new themes were no longer emerging from the data (Hennink & Kaiser, 2022). Discussions with students were transcribed, then independently analysed by 2 members of the team to identify the key themes raised, Figure 4. Table 2 shows the sub-themes or coding for each theme. Both figures show the foundation for a more detailed analysis, which will be outlined in a subsequent journal paper.

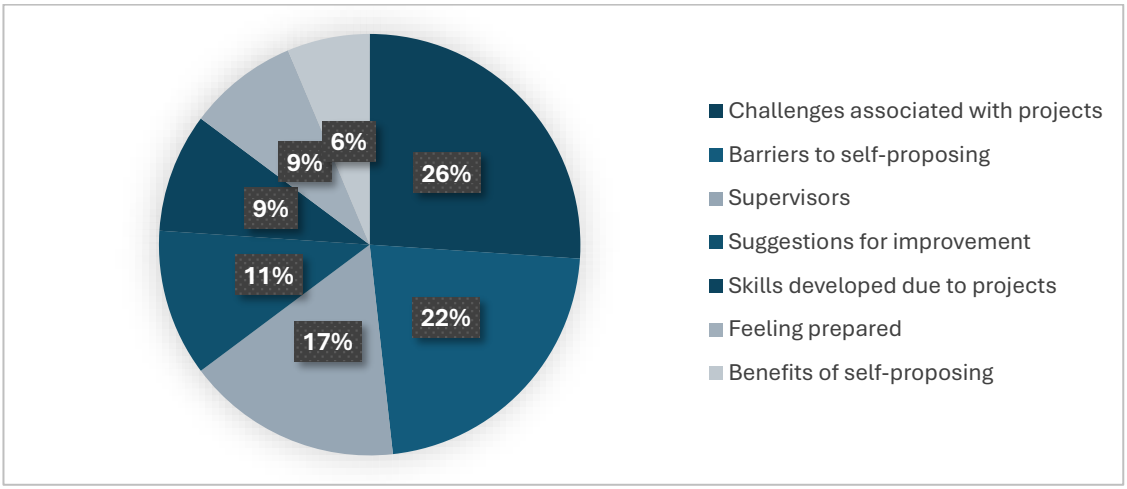

Figure 4: Distribution of student comments within analysis themes

Table 2: Themes identified within student focus groups

Theme	Sub-theme
Challenges associated with projects	Lack of technical skills, lack of transferable skills, literature review, online learning, project administration, workload
Skills developed due to projects	Technical skills, transferrable skills, useful project output
Suggestions for improvement	Earlier teaching, emulate research group/peer support, opportunities for conversations with staff
Barriers to self-proposing	Academic staff, easier/safer to select from a list, getting started, lack of knowledge, lack of passions, risk, time, unguided
Benefits of self-proposing	Alignment with career plan, alignment with interests, choosing supervisor
Supervisors	Expertise, negative experience, positive experience, project success is dependent on supervisor, relationship/familiarity with research/supervisors
Feeling prepared	Placement, prior learning, project support structure

CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

This paper provides a broad overview of results to date, highlighting the attitudes of staff and students towards self-proposed projects. A number of methods were employed to gather insight from these perspectives. Both staff and students clearly understand the benefits self-proposal could bring, noting that student motivation will likely increase, as self-proposed projects will be based on student interests. Additionally, the process offers students experience of every aspect of running a project, from scoping, feasibility and seeing it through to completion. This gives students additional freedom and ownership of their project.

Key takeaways include:

Data analysis

The data analysis process, in the early stages of the project, identified that students who self-propose their project perform well above average when compared against students selecting from a list.

Survey

The survey unpacked a wide variety of benefits from the perspective of staff, with many noting the likely increase in interest and motivation from students. The surveys also identified

challenges to be expected throughout, namely expected staff workload and lack of available time for staff and students, which will require mitigation moving forward.

Focus groups

The survey responses fed into the design of focus groups with students, shaping questions around the benefits and barriers from student perspectives. Many students anticipated similar benefits to those identified by staff, with students recognising the benefits of shaping a project around their career plan, and therefore boosting their CV.

Limitations

As noted previously, within the data analysis process, only a small number of students self-proposed, and so comparison with average marks would be more definitive with a larger sample size. For the same reason, a low proportion of focus group participants were students who self-proposed, and, again, additional perspectives from these students would provide richer insight. Further analysis is also required to establish whether elevated marks from self-proposed projects are due to higher performing students choosing to self-propose, or a direct result of project selection.

Future work

Despite a diverse population, the study demonstrates consistent outcomes, with numerous benefits available to both staff and students, alongside identifying some barriers to be expected with implementation. Work on a number of journal paper publications, featuring more detailed analysis of the research to date is underway. These will include further discussion of the challenges, and suggestions for mitigation.

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REFERENCES

Blicblau, A. S. (2004). Promotion of Final Year Capstone Projects. Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition. https://doi.org/10.18260/1-2--13783

Hennink, M., & Kaiser, B. N. (2022). Sample sizes for saturation in qualitative research: A systematic review of empirical tests. Social Science and Medicine, 292. https://doi.org/10.1016/j.socscimed.2021.114523

Hurst, K. S., James, R. D., & Raines, M. (1993). The progressive use of projects in an engineering degree course. International Journal of Mechanical Engineering Education, 21(4), 373–379. https://doi.org/10.1177/030641909302100408

Kolmos, A. (1996). Reflections on project work and problem-based learning. European Journal of Engineering Education, 21(2), 141–148. https://doi.org/10.1080/03043799608923397

Ku, H., & Goh, S. (2010). Final year engineering projects in Australia and Europe. European Journal of Engineering Education, 35(2), 161–173. https://doi.org/10.1080/03043790903497336

Picard, C., Hardebolle, C., Tormey, R., & Schiffmann, J. (2022). Which professional skills do students learn in engineering team-based projects? European Journal of Engineering Education, 47(2), 314–332. https://doi.org/10.1080/03043797.2021.1920890

Venturi, F. (2025). The Impact of Cutting-Edge Research-Based Final Year Engineering Individual Projects on Students' Learning. European Journal of Education, 60(2). https://doi.org/10.1111/ejed.70071

BIOGRAPHICAL INFORMATION

Matthew Cairns is a PhD student based in The School of Mechanical and Aerospace Engineering at Queen's University Belfast. A Mechanical Engineering graduate from the school and the first Engineering Education PhD student at QUB, his work is focused on final year projects, and the opportunities and challenges that self-proposed projects can provide.

Louise Pick is a Senior Lecturer and Director of Education in The School of Mechanical and Aerospace Engineering at Queen's University Belfast. Her work focuses on active learning, inclusive curriculum design, and student partnership to enhance engagement and outcomes. A Senior Fellow of the Higher Education Academy and former Digital Education Champion, she is committed to creating collaborative, authentic learning environments that build confidence and resilience.

Charles McCartan is a Reader in Mechanical and Aerospace Engineering at Queen's University Belfast. His research centres on curriculum innovation, active learning, and student transition, with expertise in CDIO-based approaches and authentic, project-driven experiences. He contributes to frameworks for agile, future-ready programmes and strategies that enhance engagement and retention through flexible pedagogy and curriculum design.

Eoin Cunningham is a Senior Lecturer in Mechanical and Aerospace Engineering at Queen's University Belfast, programme director for the Mechanical Engineering programme, responsible for coordinating undergraduate final year projects alongside the stage 1 Introduction to Mechanical Engineering module. His core research focuses on the valorisation of abundant and problematic industrial waste streams; specifically, their conversion into bio-based polymer fillers, functional additives and precursors.

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