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What am I learning? Student perceptions of degree-level intended learning outcomes.

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ABSTRACT

CONTEXT

In Australia, it has become more common to use graduate attributes and overarching intended learning outcomes (ILOs) to describe what skills and attributes an engineering student should have attained by the time they graduate. However, there is limited validation of students' development of these until the end of the degree. This is further confounded by the responsibility for learning being on the student, and the fuzzy alignment and overlap between the different ILOs. By exploring how engineering students interpret and internalize the degree-level ILOs, this research aims to better understand the uptake of the ILOs and their impact on the student learning experience.

PURPOSE OR GOAL

This paper critiques the literature reviewed as part of exploring the different sources of ILOs that engineering students generally experience at a degree level (e.g. graduate attributes) and how those ILOs are being used in universities, especially in the Australian context. The review also explores whether student perspectives were used to understand how they learnt the of ILOs and how those research outcomes contribute to understanding the use of ILOs.

APPROACH OR METHODOLOGY/METHODS

Initial papers on learning outcomes and graduate attributes were found using the reference primer from the 2024 Australasian Association of Engineering Education (AAEE) Research school. The remaining papers were searched using reference list screening; the search terms used, and the inclusion and exclusion criteria are outlined in the paper.

ACTUAL OR ANTICIPATED OUTCOMES

Generally, engineering students are expected to attain degree-level ILOs from three key sources: the university's graduate attributes, the degree ILOs, and the competencies listed by an external accreditation body. The degree of overlap varies between the context of the country and the individual universities; this overlap influences how students engage with them. Consequently, there is ambiguity in how students value the ILOs collectively which reflects what they aim to learn from their engineering degree.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

The literature review highlights an opportunity to investigate the ways in which the ILOs are evident in the students' learning experience, how much they value the ILOs collectively, and how the students process and embed the graduate attributes in their own learning and career development. This then contributes to informing the development of accreditation processes, degree and curriculum design, and aligned teaching strategies

KEYWORDS

intended learning outcomes, graduate attributes, engineering education, student perspective, literature review, Australia,

Introduction

In Australia, tertiary education has been tasked with equipping students with the skills and attributes to become professional engineers (Australian Council of Engineering Deans, 2023).

Engineering students must successfully learn and develop the skills and attributes taught in an engineering degree program to graduate. Due to the accreditation of the engineering degree program within Australia, the variability within the skills and attributes listed in the program's intended learning outcomes (ILOs) theoretically would be low (Engineers Australia, 2019). In other words, the accreditation process should in theory reduce the variability between the different engineering degrees by aligning the intended learning outcomes (ILOs) to the accreditation standard. However, there is low consensus on ways of ensuring that students are attaining the ILOs let alone perceive the ILOs; good teaching practice is highly contested, and each university is situated within its own local context which then influences how engineering education is implemented. This is substantiated by the goals listed in the Engineering 2035 report which describes how learning outcomes need to change by 2035 (Crosthwaite, 2021).

At the same time, how do we know if students are attaining the changing ILOs, and what do they think about them? If the motivation behind an engineering degree is to equip students to enter engineering practice with the skills and attributes they need, then there is a need to verify whether students know what skills and attributes they need to learn by the time they finish their degree. Furthermore, as students are going through the education system, there is an assumption that learning is centred on the student, so there is a subsequent assumption that students know and value what they need to learn.

Within the Australian context, much of engineering education research (EER) has focused on a specific graduate attribute, usually those that are related to the Engineers Australia (EA) Stage 1 Competencies (Ahuja et al., 2024; Kutay et al., 2022; Pearson, 2022; Quince, 2025; Rose et al., 2015). However, the validation of students attaining their university's graduate attributes is not verified holistically (i.e. all the attributes, not just the professional attributes or one singular attribute) let alone in conjunction with the EA Stage 1 Competencies or the engineering degree intended learning outcomes (ILOs). There is an opportunity to explore how students notice, value, and interact with the overarching degree-level ILOs (i.e. graduate attributes, degree ILOs, and EA Stage 1 Competencies) in the Australian context.

The aim of this paper is to critique the literature on the use of ILOs. It explores what are the different sources of degree-level ILOs, and how they are used by both students and educators. The findings will contribute to future research direction that may inform the development of accreditation processes, degree and curriculum design, and aligned teaching strategies

Methods

This section outlines the search strategy used to find studies on degree-level ILOs. The search strategy started with a list of recommended readings provided by the Australasian Association for Engineering Education (AAEE) 2024 Research School. The AAEE Engineering Education Research (EER) School aims to equip academics to begin to research within the field of engineering education. The facilitators and experienced EER researchers compiled a list of journal and conference papers as a primer for new researchers entering the EER space. The literature abstracts and reference lists were then screened based on the following criteria:

- Excluding literature on individual subject ILOs, as the purpose of the review is on degree-level ILOs.
- Excluding literature on contexts that are not a bachelor's degree (e.g. vocational education and training (VET) programs and master's degrees), as the overarching scope is to investigate undergraduate engineering degrees.

- Including literature on non-engineering bachelor's degrees if the research participants are students and the ILOs of focus are graduate attributes, as graduate attributes are theoretically not degree specific so it may inform how students relate with this subset of degree-level ILOs.

The resulting papers were then used for additional rounds of reference list screening and this process occurred iteratively. This process created a web of literature which was then clustered into the following topics:

- Engineering degree or non-engineering degree to compare whether different degrees experience different degree-level ILOs
- Australian engineering or international to compare how different countries influence the engineering context
- Type of ILO (e.g. Graduate attributes, course ILOs, accreditation competencies) to compare how the different levels of ILOs are structured within education curriculum
- Student participants or non-student participants (e.g. staff) to compare how different cohorts interact with the degree-level ILOs.

Degree-level ILOs and where to find them

Degree-level learning outcomes encompass the different learning goals that are designed to apply over the overarching degree. In other words, from the student perspective, degree-level ILOs are goals that should be achieved by completing the engineering degree rather than an individual subject or a single assignment. So far, there are three key sources of degree-level ILOs reported in engineering literature: graduate attributes, course ILOs, and the competencies defined by the external engineering accreditation body.

Graduate Attributes

At a whole-of-university level, there are graduate attributes. These types of ILOs describe the attributes and competencies that students should have gained by attending the university. Barrie (2012) has extended this definition by referring to graduate attributes as generic attributes as they are not specific to a singular degree. Similarly, Donleavy (2012) and Mahon (2022) report that graduate attributes are a response to the industry demands to produce more employable graduates; this could even be abstracted further to distinguishing different graduates based on which university they attend. Thus the industry and university are key stakeholders in the development of graduate attributes (Barrie, 2012; Donleavy, 2012; Mahon, 2022).

Theoretically, no matter what qualification the student completes at the university, they should have gained the university's graduate attributes. In practice, this is not necessarily true for two key reasons: the interpretation by the university faculties, and the validation of student learning. The different faculties or departments within the university may have flexibility to interpret and, in some cases, rewrite or add to the graduate attributes; this variation of the graduate attributes is also known as faculty graduate attributes (Biggs et al., 2022; University of Technology Sydney, n.d.). Consequentially, students from different degrees may graduate with the different interpretation of the graduate attributes. This variation in interpretation is then influenced by how the university validates the attainment of the graduate attributes. There is usually an assumption that if the graduate attributes are aligned and embedded with the course ILOs, then the students would have intrinsically developed the graduate attributes.

Course ILOs

The second set of degree-level ILOs are the course ILOs. The term ‘degree course’ is also known in literature as a ‘degree program’ depending on the university and even between faculty or classes; for this paper, the term ‘course’ will be used as it is distinct from the term degree-level ILOs. The course ILOs typically list out the set of attributes, skills, and competencies that make the different degrees unique (e.g. distinguish a design degree from an engineering degree). However, in most cases, the course ILOs are reflective of the graduate attributes that are used within the faculty, so in practice, the boundary between what is a graduate attribute and what is a course ILO is permeable. The degree of permeability then varies depending on the university and its context; for example, the study of how students perceive the graduate attributes are influenced by the alignment of the course ILOs with the graduate attributes.

Competencies from external accreditation organisations

The third set of degree-level ILOs depends on whether the engineering degree is accredited. Pearson (2022) argues that there is an incentive to have engineering degrees be accredited to increase the attractiveness of the engineering degree. This is secondary to ensuring that the quality of professional engineers meet an international standard set by the International Engineering Alliance (IEA), also known as the Washington Accord). Different countries may have varying signatories or accrediting bodies that oversee the accreditation process. With the Australian context in mind, the Washington Accord signatory is Engineers Australia (EA), and they use a list of ILOs known as the EA Stage 1 Competency Standard (Engineers Australia, 2019). However, by comparing the EA Stage 1 Competencies to the published IEA graduate attributes (by which I mean the international list of graduate attributes that the Washington Accord upholds), the EA Stage 1 competencies are an interpretation/revision of the IEA graduate attributes (Engineers Australia, 2019, p. 1; International Engineering Alliance, 2024). In the National Competency Standard for Engineering 2025 report, EA argues that the revisions are to ensure that the IEA graduate attributes are suitable for the entry-to-practice demand of the Australian context (Engineers Australia, 2025). This case demonstrates that there is flexibility between signatories on how the ILOs listed by the Washington Accord are developed and accredited in each country. Consequently, for Australian engineering degrees to meet the accreditation standards set by EA, the course ILOs need to be aligned to the Stage 1 Competency Standards; this adds an additional level of complexity of the course ILOs as they are then reflective of both accreditation competencies and the graduate attributes.

In summary, the three sources of degree-level ILOs I have identified so far are graduate attributes, course ILOs, and the competencies from external accreditation bodies. This is graphically summarised in Figure 1.

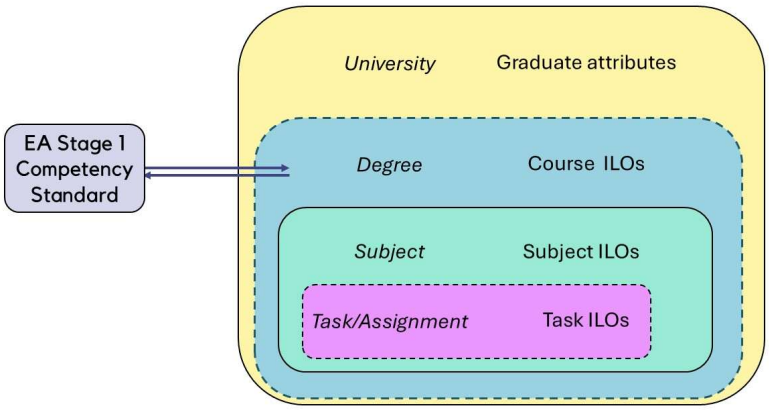

Figure 1: Relationships between ILOs in an Australian Engineering Degree

The graduate attributes and the course ILOs are at the degree-level where the boundary between university level and degree level is permeable. The course ILOs and graduate attributes are within the university context, so it is controllable by the university, but the EA Stage 1 Competency Standard (which directly influences the engineering course ILOs) are an external set of attributes that are applied at the degree level. These overarching ILOs then influence the various subjects/units and tasks within the engineering degree, which theoretically, students will directly engage with. There is then a heavy reliance on the constructive alignment between the different layers to ensure that the students engage with and attain the overarching goals.

Degree-level ILOs in practice

Why should we care about the different degree-level ILOs? As discussed in the previous section, the degree-level ILOs have a trickle-down effect on the subjects and tasks which the students interact with, hence the degree-level ILOs influence the overarching learning experience of the engineering degree. However, does this hold true in practice? The influences on students attaining degree-level ILOs have been explored in various contexts. Factors include countries, degrees, and cohort (e.g. educators, students, graduates). This section explores the discourse of the different ILOs and how studies have used the lens of student perspectives within different contexts.

Design and implementation

The purpose and usage of ILOs in practice is not straightforward nor without debate in any university degree, not just engineering degrees. Erikson & Erikson (2019) summarise the discourse on ILO design and implementation into two key points:

1. Mismatching purposes: ILOs in any university degree are over-administration to the point of being just a managerial tool by which I mean ILOs have become mostly encapsulated in the teaching domain.
2. Inconsistent practice: Those ILOs are frequently misused, poorly implemented, and misinterpreted in both the teaching and learning domain.

The first critique is around mismatching purposes of ILOs, from informing teaching practices versus administrative accreditation requirements. In other words, ILOs have shifted away from informing teaching practices to solely benefitting the administration and managerial practices of education institutions (Erikson & Erikson, 2019; Hussey & Smith, 2002, 2008). ILOs, being a statement of the learning goals, can be regulated and managed by the education institutions to align with the institutional performance or to meet accreditation standards; this becomes problematic when ILOs no longer prioritise benefiting student learning or teaching pedagogy. In other words, if ILOs shift from being mostly a teaching and learning tool to mostly administrative tool, the ILOs potential as an education tool is reduced. The managerial attitude of ILOs is critiqued in literature as not beneficial for learning because it amplifies the box-ticking attitude and over-constrains learning, leaving educators not using the tool to support learning (Eidesen et al., 2023; Erikson & Erikson, 2019; Holmes, 2020; Hussey & Smith, 2002; Sanyal & Gupta, 2018). For example, if having a list of ILOs is a required component of a subject there is an element of box-ticking to get the subject above the line so it can be offered to students faster. This becomes problematic when there is a lack of verification on whether the subject's teaching activities are reflective of the ILOs in practice (as opposed to just teaching content at the convenor's discretion); consequently, this leads to ambiguity on whether students are achieving the ILOs as the ILOs are no longer aligned to teaching practice. Overall, this highlights that in practice, ILOs are designed and/or used with mismatching purposes.

The second critique is on inconsistent practice by which the development and implementation standards of ILOs by teachers are not consistent between all teachers, and the interpretation and use by students is also not consistent (Brooks et al., 2014; Kumpas-Lenk et al., 2018; Pearson, 2022; Sanyal & Gupta, 2018). The critique of uniform use by teachers and students is discussed more broadly in literature because the ways which the development and implementation becomes inconsistent varies depending on discipline and social context (Erikson & Erikson, 2019; Hussey & Smith, 2002). The theory of ILOs takes a key assumption that educators know what they are and how to use them. Hussey & Smith (2008) highlight that the investment and experience in teaching and education varies between academics, so the ability to communicate and demonstrate the learning outcomes clearly to the students is not consistent; there is a lack of shared understanding between curriculum developers and teachers. The assumption that students implicitly know how to interpret and use ILOs is not necessarily true either. Holmes (2020) reports that students have a limited understanding of ILOs so there is a phenomenon where ILOs further confuse the student or get completely ignored. This is supported by Erikson & Erikson (2019) who report that students are less likely to interpret and internalise the ILOs in a subject or discipline that is more unfamiliar. Consequentially, there is a weakened transfer of knowledge if students have a limited understanding of learning expectations and how to manage their own learning and development; there is a lack of shared understanding between students and teachers. In summary there is inconsistent practice in ILO development and implementation.

Student Perspective on ILOs

I've established in the previous section that there are two overarching critiques on ILOs: mismatching purposes and inconsistent practice. Then how does the student perspective give us insight into the use of ILOs? One suggested benefit is that students are outside or not wholly encapsulated in the teaching domain. London et al. (2013) found that in their context, the educators used three different degree-level ILOs but there was no consistent alignment. The study showed that the teaching staff were able to identify the alignment between the sets of degree-level ILOs, but the study calls for further exploration into the low consensus in low alignment ILOs and from perspectives beyond staff. In other words, student perspectives can evaluate the alignment of ILOs intended by teaching staff. Thus, there is a scope for using student feedback and perspectives to show their relationship with degree-level ILOs.

There has been a response by the research community into using student perspectives to evaluate ILOs. As highlighted previously in Figure 1, the engineering degree structure and positionality within the university will influence the ILOs. Martin (2021) argues that the relationship between students and the degree-level ILOs are dependent on the specific major the student enrols in (e.g. biomedical engineering compared to civil engineering). In their study, Martin (2021) observed that, what the overall goals of the engineering degree was perceived by students were influenced by what major they selected. However, the study was not scoped to focus on the different degree-level ILOs. Similarly, Kumpas-Lenk et al. (2018) argues that the student perception of the degree-level ILOs is not just dependent on the major selected but how the course ILOs are written). They argue that there is a relationship between engagement and how challenging the ILOs are. However, the study was limited to non-STEM students and the associated course ILOs so there was limited perspective of the engineering degree-level ILOs.

There is some consensus amongst researchers (Lawrence et al., 2024; Pearson, 2022; Quince, 2025) that engineering students have a bias towards certain attributes as opposed to a uniform approach to the IEA graduate attributes. It could then be argued that utilising student feedback on the overarching degree-ILOs has value in informing the various learning pathways as well as how students value the engineering degrees. However, it can also be argued that by focusing on one set of the degree-level ILOs, there is limited understanding of how students view the bigger yet more complex picture of the engineering degree.

Implications and Conclusions

So now what? What are the implications of understanding how students view the various sets of degree-level ILOs? The literature review has highlighted various sources of degree-level ILOs in an Australian engineering degree and the plethora of work done to understand those sources of degree-level ILOs. However, the literature review has also exposed an opportunity to explore how students perceive most, if not all the degree-level ILOs holistically. Consequentially, the literature review presented in this paper is part of a research project that aims to contribute to the improvement of accreditation processes, curriculum design, and teaching practice. By exploring how engineering students interpret and internalize the engineering degree-level ILOs, the research project aims to better understand the uptake of the attributes, skills and competencies, and its' impact on the student learning experience. I address this aim through the following research questions:

> RQ1: How do undergraduate engineering students engage with engineering degree-level ILOs in Australia?
>
> RQ2: How are the different engineering degree-level ILOs valued from the student perspective?

The research hypothesises that students are not actively seeking the graduate attributes, let alone have awareness of them, and that they do not value all the graduate attributes equally (similar to the arguments made by Lawrence et al. (2024) and Quince et al. (2025)). Findings from this project will give insight onto the different ways in which students engage with the graduate attributes, how much they interact with the graduate attributes, and how the students process and embed the graduate attributes in their own learning and career development.

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