Understanding Instructor Perspectives and Course Challenges in FSE 100: A Learning Engineering Approach to Improving the Course

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Course Evaluation first-year engineering

Introduction to Engineering (FSE 100) serves as a foundational experience for first-year students, acting as the course to introduce core engineering principles, like design thinking, teamwork, and professionalism. Given its central role, it is critical to understand the perspectives of its stakeholders. Using a learning engineering approach, this study seeks to understand how FSE 100 can be improved, focusing on data, iterative design, and stakeholder insights. Conducted interviews gained insight from the instructor perspective highlighting that a limited credit hours format creates challenges of pacing, workload, and student engagement. These interviews will inform a future survey meant to gain student perspective of FSE 100.

Introduction

Students often perceive introductory engineering courses as unnecessary or disconnected from later coursework. Informal feedback from students enrolled in FSE 100 at Arizona State University (ASU) reflects this pattern, with many citing a misalignment between the course workload and its 2-credit value, as well as difficulty understanding how course content connects to future engineering classes. These perceptions pose a challenge that conflicts with ASU's mission, as unclear course structure and perceived irrelevance can undermine student belonging and equitable access to engineering pathways.

Introductory engineering courses play a critical role in supporting students who may not enter higher education with prior exposure to engineering concepts or practices. When these courses are unengaging, poorly aligned with expectations, or constrained by structural limitations, they can negatively impact student motivation and contribute to lower performance, major changes, or attrition (Ohland et al., 2008). As such, understanding how these courses are designed, implemented, and experienced is essential, particularly in compressed, low-credit formats where instructional choices and structural constraints may have outsized effects on student outcomes.

Guided by a Learning Engineering (LE) approach, this study examines instructor perspectives as part of an iterative, human-centered process aimed at improving FSE 100. LE emphasizes understanding challenges in context, collecting and analyzing multiple sources of evidence, and using that evidence to inform later design decisions (Goodell & Kolodner, 2022; Goodell & Kessler, 2023). Within this framework, the present study represents a nested LE cycle situated within a broader, ongoing effort to improve the course. LE processes are often nested or concurrent, with evidence generated in one phase informing decisions and iterations at other levels of the design system (Totino & Kessler, 2024).

This phase of the project focuses on investigating instructor perspectives to clarify course purpose, instructional priorities, and structural constraints that shape the learning experience. Instructor insights serve as a critical source of evidence for understanding how the course is intended to function and how design decisions are enacted in practice. Findings from this phase are intended to inform subsequent data collection efforts, including the development of a student survey assessing engagement, learning experiences, and perceptions of course effectiveness, as well as future iterations of course design.

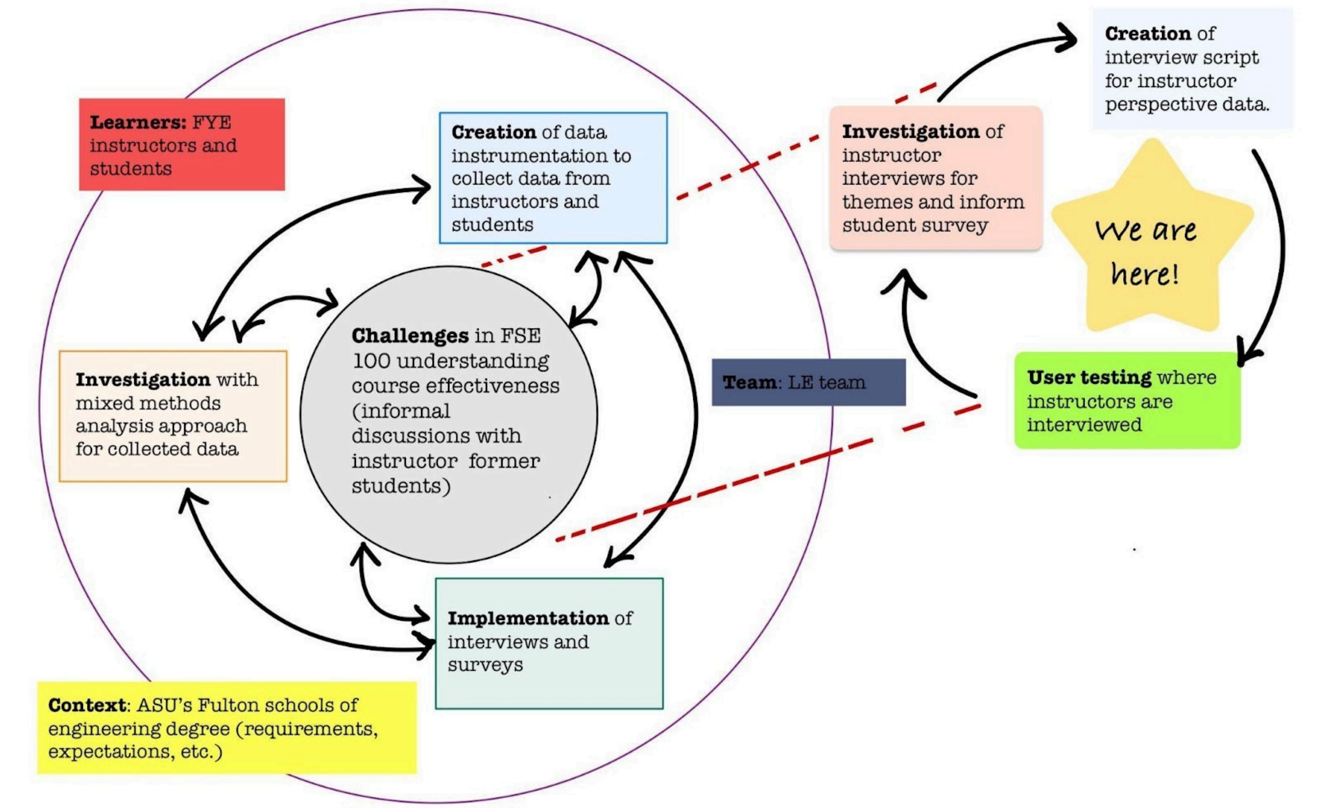
Informed by this LE framing, the following research questions shape the research process, analysis of results, and later discussion of improvements:

RQ1: Understand instructor perspectives on FSE 100's purpose, learning outcomes, and instructional priorities, and how well the course prepares students for later coursework.

RQ2: Identify how the 2-credit, one-semester format, pacing, workload, and content influence instructors and students.

RQ3: Use findings from faculty interviews regarding course development to design a student survey in a subsequent phase assessing perceptions of course effectiveness.

Figure. 1.
A depiction of the LE cycle showing where our project work fits within the process.



Literature

Informed by a Learning Engineering (LE) approach, the following literature highlights evidence related to first-year engineering course (FYE) design, instructor decision-making, and structural features that influence student experiences and outcomes. A consistent finding in engineering education studies is that early identity and affective development impact student retention in engineering majors. Godwin et al. developed measures of identity in engineering. It found that affective constructs, including interest, identification, and agency, predict the likelihood of students to persist in engineering (Godwin et al., 2016). First-year courses provide the first sustained exposure to engineering, meaning this is when the development of foundational values takes place. Structuring FYE courses to promote positive affective constructs is crucial for building an engineering identity and retaining engineering students.

Instructor perspectives and their instructional choices provide critical evidence for understanding the first-year experience and therefore affect student outcomes. Wahed and Pitterson showed this by investigating the influence of pedagogical knowledge on courses specifically in a FYE context. The research involved conducting interviews with first-year course instructors. It concluded that first-year professors shape student belonging and help-seeking opportunities because of decisions their jobs entail, such as amount of teaming to include, how to intervene in team issues, and how to define “professional” work (Wahed & Pitterson, 2024). This argues that instructor data, including what they notice, value, and put into practice, is valuable evidence to consider when resigning an introduction engineering sequence.

Purpose and structure must also be considered when redesigning a FYE course. Ohland et al. showed that structure is directly linked to retention outcomes. Their study involved multiple institutions, finding that students enrolled in cohesive, structured FYE programs showed higher retention rates than students in programs with fragmented or inconsistent introductory curriculums (Ohland et al., 2008). Therefore, the structure of a course should be considered when designing for increased retention rates. Marra et al. supported this conclusion with its finding that structured first-year experiences impact the students' sense of belonging. They concluded that women who persevered in engineering attributed their motivation and sense of belonging to courses with supportive expectations and structures early on in their engineering course load (Marra et al., 2012). First-year curricula with a strong, cohesive structure give students greater opportunity to develop important engineering skills, discover relevance, and form connections. This increased belonging creates a framework that encourages persistence from students.

The literature demonstrates that FYE courses are critical in influencing student outcomes. They create a setting where the development of student engineering identity, instructor perspectives, and course structure all interact to support learning, foster belonging, and promote persistence in engineering.

Methods

For the present study, semi-structured interviews lasting approximately 45-60 minutes were conducted by members of the research team. Within the LE framing of this project, instructor interviews serve as an early evidence-gathering step to inform ongoing design decisions and subsequent iterations of the course improvement process. Interviews were conducted over Zoom, with audio-recorded transcripts collected with participant consent. Data from interviews were used to identify key themes related to course effectiveness, instructional and structural challenges, and opportunities for improvement. As this is an ongoing study, findings from this phase will also inform revisions to the interview protocol and the development of a student survey for a subsequent phase.

The interview protocol consisted of five sections (each containing three to five questions) focused on course governance and decision-making, course effectiveness, pacing and workload, student engagement, and course structure.

Participants

Participants were recruited from ASU faculty, including instructors teaching FSE 100 and advisors within the Fulton Schools of Engineering. Recruitment occurred via email. At the time of reporting, three instructors agreed to participate, with one interview completed; recruitment and data collection are ongoing.

Data Collection & Analysis

Each interview involved one participant and two researchers, with one researcher serving as the primary interviewer and the other documenting observational notes and managing recording. Interview transcripts were de-identified and edited for clarity prior to analysis.

Following editing, transcripts were analyzed using a hybrid thematic analysis approach combining inductive and deductive coding, consistent with established qualitative methods for demonstrating rigor (Fereday & Muir-Cochrane, 2006). Inductive coding was conducted by one researcher to identify emergent themes, while deductive coding was conducted by a second researcher using a codebook aligned with the research questions. This approach enabled comparison across analytic perspectives and supported evaluation of how effectively the interview protocol addressed the study's research questions.

Results

As of now, two interviews with FSE 100 instructors have been conducted and recruitment is ongoing. Analysis of the instructor interviews (P01 and P02) revealed three major themes related to course effectiveness, student experience, and the development of FSE 100 over time.

Theme 1: Instructor Views on Purpose, Challenge, and Student Experience

P01 described FSE 100 as an introductory exposure course that gives students a “taste of all departments of engineering” and helps them begin recognizing engineering communication and seeing themselves as engineers. Coding was highlighted as an area where students often experience unfamiliarity and frustration, but it can also spark interest for those new to the material. The course intentionally requires students to confront “uncertainty,” “ambiguity,” and “iteration,” leading them to face (and often dislike) failure before enjoying the final outcome when designs work. As P01 noted, students often “love the outcome, [but] hate the process.” P02 echoed this, stating the most popular activity among students is the final build as they feel this “sense of accomplishment” and “...to have it complete at the end, [the students] are just full of joy.” These insights will inform student survey phase, particularly with respect to engagement, perceived difficulty, and early engineering identity.

Theme 2: Motivation Barriers Linked to the 2-Credit Structure

Student motivation was the most frequently coded factor, with instructors consistently identifying a misalignment between workload and the course’s 2-credit designation as a primary barrier. Students often questioned, “This is just 2 credits, why am I doing so much?”, which reduced their willingness to engage with or persist through challenging tasks. Instructors described strategies such as gamification, enjoyable in-class activities, and instructional flexibility as effective in mitigating these motivation challenges. Several also noted that increasing the course to 3 credits or adjusting the pacing could better support student motivation. As P02 stated, they “do tell [my class] straight up front, [the class] is a 2-credit hour class that’s really the work of a 3-credit hour class.”

Theme 3: Decentralized Curriculum and Limited Oversight Across Sections

Instructors described FSE 100 as a course with high-level learning outcomes that were collaboratively established by faculty teaching FSE 100 and EGR 101/102 courses, particularly given the absence of ABET-associated learning outcomes for the introductory course. While this shared agreement provides general direction, instructors indicated that curriculum implementation below this level varies substantially across sections. At the section level, instructional decisions were described as largely autonomous, resulting in what one instructor characterized as a faculty “free-for-all,” with limited coordination, oversight, or peer review. Reflecting this concern, P02 expressed a desire for “more oversight … and more peer review” to support greater coherence across sections. As described by instructors, meaningful information flow across the broader engineering curriculum, from FSE 100 (or EGR 101/102) through mid-level coursework and capstone experiences, primarily occurs when faculty teach multiple courses within the pipeline. In these cases, instructors gain direct insight into how early course experiences align with downstream expectations, highlighting the lack of formal structures to support shared understanding and curricular coherence across the program.

Discussion

Findings from the initial instructor interviews align with prior research highlighting the role of first-year engineering (FYE) courses in shaping students’ early affective experiences, including motivation, frustration, and emerging engineering identity. Instructors described FSE 100 as intentionally exposing students to uncertainty, ambiguity, and iteration, requiring them to engage with unfamiliar tools and confront failure as part of the learning process. While students may initially resist this process, instructors noted that successful outcomes are often associated with strong feelings of accomplishment, consistent with research linking early affective experiences to persistence in engineering (Godwin et al., 2016).

Motivation emerged as a central concern, particularly due to the perceived misalignment between course workload and its 2-credit designation. Instructors reported that this mismatch can reduce student engagement and persistence, a finding consistent with prior work demonstrating how structural features of FYE courses influence belonging and retention (Ohland et al., 2008; Marra et al., 2012). Instructional strategies such as gamification, flexible deadlines, and engaging in-class activities were described as ways to mitigate these challenges, reinforcing evidence that instructor decision-making plays a key role in supporting productive learning environments (Wahed & Pitterson, 2024).

Instructors also identified decentralized curriculum implementation and limited oversight across sections as a broader structural challenge. Although high-level learning outcomes were aligned with downstream courses, variation in section-level execution and limited coordination may contribute to inconsistent student experiences. From a LE perspective, the findings presented here represent early evidence intended to inform subsequent research design aimed at more fully understanding the FSE 100 context, rather than final conclusions about course effectiveness. This evidence, together with additional instructor interviews and future data collection, will further refine understanding of course structures and instructional practices and inform later suggestions for course design improvements.

Conclusion

This study highlights how structural and instructional features of FSE 100 shape early student experiences in engineering. Preliminary instructor insights suggest that the 2-credit format, pacing demands, and decentralized curriculum implementation introduce challenges related to motivation, workload expectations, and instructional coherence.

Situated within a broader LE process, these findings provide instructor-centered evidence to inform subsequent phases of course improvement. Insights from this phase will guide development of a student survey to capture learner perspectives and support evidence-informed decisions about future iterations of FSE 100, with the goal of strengthening engagement, belonging, and persistence in engineering.

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