4.10

Engineering Innovation and Leadership at The University of Texas at El Paso

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The BSc in Engineering Innovation and Leadership (E-Lead) at The University of Texas at El Paso (UTEP) is an ABET-accredited engineering degree that is transforming how engineering is learned and taught. At its core, E-Lead is an integrated engineering degree that provides students with a diverse foundation in multidisciplinary engineering knowledge, leadership theory and practice, innovation skills, and an understanding of business. The degree is customisable, allowing students to couple their E-Lead education modules with a focus on a specific traditional engineering discipline. This content knowledge is then integrated and applied through the E-Lead core modules each semester, enhanced by peer and faculty support and extracurricular programming offered by the department. As an undergraduate degree, team-based, project-based learning is the cornerstone of how we support our students in developing transferable competencies and skills. This project work is facilitated in our dedicated studio space, where students not only attend class but can collaborate on campus after hours and use the available prototyping lab to work on their projects. Therefore, the E-Lead degree focuses on developing a learning environment where transferable skills flourish, using real-life scenarios and projects to prepare students to take the initiative to 'engineer' the future and solve sociotechnical challenges. The chapter concludes with practice-focused recommendations for designing integrated engineering leadership curricula, including strategies for scaffolding transferable skills, aligning leadership development with technical coursework, and engaging industry partners.

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1 Introduction

The BSc in Engineering Innovation and Leadership at UTEP, also known as the E-Lead degree, was established with the overarching purpose of revolutionising engineering education — within the institution, nationally, and internationally. It was designed to address a critical gap identified by employers: while engineers possessed strong technical capabilities, they often lacked essential professional skills. Therefore, a key aim of the degree is to cultivate these skills, including interpersonal interaction, financial literacy, policy understanding, and team leadership, by integrating them within a broader context of engineering studies. This approach moves beyond purely technical instruction to incorporate entrepreneurial skills, enabling students to grasp the broader societal and economic implications of their engineering work. We say that we have created a degree that is 'more than engineering'.

The degree was a direct response to pressures from both industry and the engineering education community, aiming to create a new educational model that provides practical experience, rather than focusing solely on theoretical and technical concepts. The vision for E-Lead is to foster the holistic development of students, enabling them to think comprehensively about problems and their impacts. It emphasises the cultivation of engineering leaders through a curriculum heavily reliant on meaningful, team-based, real-world projects spanning all years of the degree. These projects serve as crucial vehicles for developing a diverse range of skills, including leadership. Conceived as an agile 'tugboat', the degree is a flexible model that can influence and lead the entire engineering college towards adopting innovative teaching methodologies, adapting as needed to evolving educational and industry demands.

To further articulate how E-Lead seeks to achieve this integrated learning for our students, we seek to share the philosophy and approach to developing the degree by establishing institutional context, describing conceptual and theoretical underpinnings of our curricular design and improvement, and identifying future directions for growth. In this chapter, *competencies* refer to the integrated combinations of knowledge, skills, and attitudes, while *transferable skills* describe capabilities applicable across engineering contexts, such as teamwork, communication, and ethical reasoning. In some literature, professional skills are broadly termed 'leadership' (Duderstadt, 2008). Therefore, in this chapter, leadership is defined not as a positional role, but as a set of transferable engineering competencies that enable individuals and teams to design, collaborate, and act responsibly within these complex sociotechnical systems. This interpretation aligns with the SEFI skills framework (SEFI, 2025) and the European Qualifications Framework's emphasis on autonomy, responsibility, and professional competence. This chapter is also structured to align with the handbook by first defining leadership competencies, then describing curriculum design and implementation and finally offering recommendations for adaptation and other institutional contexts.

2 Institutional context and need

The University of Texas at El Paso (UTEP) is an open-access, Hispanic-serving institution located on the United States-Mexico border, where approximately 84% of the student population is Hispanic, more than half are the first in their family to go to college, and approximately 47% are from the lowest income quartile. Thus, UTEP contributes to the upward social mobility of its graduates. Of the nearly 25,000 students, approximately 5,000 are pursuing engineering degrees. As an open-access institution, all students with a high school diploma or equivalent are accepted. Additionally, regardless of their academic preparation, students are accepted to any major of their choosing at UTEP, presenting unique challenges especially within the College of Engineering. Students therefore begin their engineering degrees with varying levels of preparation. As E-Lead serves students who have historically been underserved by higher education, cultural and economic considerations were key in designing the E-Lead degree.

The institutional context for the E-Lead degree began with the arrival of a new dean, the administrative head of all faculty and departments, at UTEP in July 2007, who, in their first dean assignment, was exposed to national discussions on engineering education reform at a nationally sponsored conference. This experience, particularly through reports like Duderstadt's (2010) *Engineering for a changing world*, provided a crucial understanding of the broader need for change. Internally, the E-Lead degree was envisioned as a catalyst within the larger Engineering college, capable of leading and influencing curriculum changes across traditional departmental structures and indicating an institutional willingness to innovate. Furthermore, internal discussions had already generated momentum for an engineering leadership programme, suggesting a receptive environment within UTEP for such an initiative. The need for the E-Lead degree was multifaceted, driven primarily by a long-standing national imperative for fundamental changes in engineering education in what is taught and how. A significant factor was the consistent feedback from industry partners that while engineering graduates were technically proficient, they lacked essential professional skills, encompassing abilities in human interaction, financial understanding, policy navigation, and team leadership. The degree was thus a direct response to this industry demand for more well-rounded engineers.

This led to the desire for a new educational model, one that would mirror professional fields like medicine by providing practical, real-world experience through rotations and hands-on projects, moving away from purely theoretical classroom learning. Beyond immediate educational needs, the E-Lead degree was seen as essential for contributing to the innovation engine for the US and addressing major issues that are facing humankind in general, with the belief that UTEP graduates would play a crucial role in tackling complex societal challenges. This vision extended to the idea of engineering becoming the liberal arts degree of the 21st century, suggesting a future need for broader access to engineering principles and a model for integrating engineering into wider curricula, including primary and secondary education, due to the increasing need for technical skills across diverse fields.

3 Competencies and skills development

In E-Lead, we define transferable skills in engineering as those professional and interpersonal capabilities and competencies beyond strict technical expertise that are crucial to an engineer's success and adaptability in diverse professional settings. They are the skills in demand by the employers of our students but are often neglected in traditional technically focused training. These transferable skills are seen as essential for engineers to drive innovation for the US and address major issues that mankind is facing, implying that complex global challenges necessitate leadership and a broad skillset. Their acquisition is fundamental for accelerating career advancement into leadership roles and for adapting to an ever-changing professional landscape, supporting the idea that engineering education, with its blend of technical and transferable skills, making engineers versatile across numerous fields. Finally, early student exposure to such teamwork and interaction facilitates the forging of relationships and the creation of support structures, contributing significantly to students' personal and professional growth. These skills are vital for fostering the holistic development of engineers, transforming them into well-rounded professionals capable of understanding and contributing to the wider implications of their work.

In reviewing the goals of our programme with students and practicing engineers, we realised that the specific transferable skills that were most valued could be encompassed in the concept of engineering leadership — including effective interpersonal interaction, financial understanding, policy navigation, team leadership, and problem-solving within a broader context. Furthermore, unlike how most of our engineers are trained in a classroom setting, engineering work includes robust teamwork and collaboration abilities, recognising that engineers rarely work in isolation and must foster trust and communication within teams. Business acumen, involving a grasp of financial concepts and business models, is also a key component. Therefore, we use the definition of an engineering leader as one who will: *"(a) employ the full range of engineering skills and knowledge in the design of sociotechnical innovations, while (b) seeking to understand, embrace, and address the current and future impact of their work in context by (c) actively fostering engaged and productive relationships with diverse stakeholders, including themselves and their team, the users of their technologies, and those impacted by their engineering work"* (Kendall et al., 2022, p. 17).

3.1 Leadership development

Leadership development in the E-Lead degree is systematically scaffolded through a progressive and deeply integrated approach, focusing on hands-on, team-based projects that grow in complexity and scope throughout the entire curriculum. This foundational aspect means that leadership skills are not isolated within a single module, but are continuously developed from the first year onwards, providing ongoing exposure to knowledge, skills, and mindsets necessary to foster engineering leadership. This development is seamlessly intertwined with technical learning and the acquisition of business acumen, ensuring that students apply leadership principles directly to engineering problem solving. This requires students to consider the financial and societal impacts of their engineering work. This integrated method solidifies leadership as an essential facet of engineering practice, rather than an add-on.

The consistent focus on project work follows a natural progression, with projects becoming increasingly complex and relevant to real-world applications. This progression allows for a systematic scaffolding of leadership abilities, advancing from basic teamwork and communication to more sophisticated team management, complex problem solving, and decision making. Furthermore, students are trained to adopt a holistic problem-solving mindset, encouraging them to think broadly about challenges and their wider implications, thus fostering a comprehensive leadership approach. Early in the degree, a strong emphasis on teamwork and interpersonal interaction helps students forge relationships and build a crucial support structure by setting expectations and preparing them for a collaborative professional environment. By the end of the degree, E-Lead intentionally connects students with companies to work on a capstone design project, reinforcing the practical application of these scaffolded skills and preparing graduates for real-world leadership roles.

3.2 Theoretical framing

This chapter adopts the Contextual Engineering Leadership Development (CELD) framework (Campos Valles et al., 2025; Kendall et al., 2018; see also Chapter 2.5 in this handbook) to provide conceptual clarity around how leadership is defined, developed, and scaffolded within the E-Lead degree. CELD frames engineering leadership as a developmental and contextual process that is inseparable from technical work, rather than a generic or positional skill set. Within this framework, leadership development progresses across three interrelated domains: effectual behaviour at the individual level (e.g., identity, motivation, reflection, and initiative), collaboration at the team level (e.g., communication, coordination, and shared problem solving), and contextual awareness at the societal level (e.g., ethical reasoning, stakeholder engagement, and social and economic impacts of engineering work). This framing aligns with E-Lead's curriculum-level scaffolding, in which students encounter increasingly complex engineering projects that require simultaneous growth in technical competence, teamwork, and sociotechnical judgement over time, rather than isolated leadership instruction.

Complementing CELD, intrinsic motivation and self-directed learning (SDL) serve as the philosophical underpinnings of how learning is designed to occur within the E-Lead degree. Drawing on problem-based learning literature, SDL is understood as both a learner capability and a deliberate design feature of the curriculum, wherein students — supported through structured projects, facilitation, and reflection — progressively assume responsibility for defining their own learning needs, identifying and evaluating resources, and assessing their own learning (Loyens et al., 2008). Intrinsic motivation is fostered through meaningful, authentic engineering problems and autonomy-supporting learning environments, particularly within the cohort-based studio model used in E-Lead. Importantly, SDL in this context does not imply unguided or independent learning; rather, it reflects scaffolded autonomy, ensuring that students with diverse levels of preparation are supported as they develop the capacity to 'learn how to learn' and to enact leadership within engineering practice.

3.3 Change management

When communicating our approach to leadership development to students and fostering their own motivation to grow as leaders, we apply a concise framing that we call the 'three Cs' of E-Lead. The three Cs, adapted from the leadership development framework used at the United States Military Academy at West Point (Donnithorne, 2009), are foundational pillars that describe the aspects of leadership we focus on. The pillars focus on students' adaptability to change and growth throughout their E-Lead experience. The pillars include:

- *Character (who you are).* This pillar emphasizes personal integrity, self-awareness, and ethical grounding. Students are encouraged to reflect on their values, motivations, and identity as future leaders. The goal is to cultivate individuals who lead with authenticity and purpose.
- *Competence (what you know)*. Competence refers to the technical knowledge and intellectual foundation required to lead effectively in engineering contexts. The E-Lead curriculum integrates rigorous engineering coursework with leadership theory and business acumen to ensure students are well-prepared for complex problem solving and decision making.
- *Capacity (how you catalyse change)*. This pillar focuses on the ability to apply knowledge and character in real-world settings. It includes skills like collaboration, innovation, and initiative. Students develop the capacity to lead teams, manage projects, and drive change in diverse environments.

These three pillars are central to UTEP's vision of producing 'Renaissance engineers' who are holistically educated and capable of leading in a variety of contexts.

4 Curriculum design

4.1 Philosophy and design

To foster an intrinsically motivating learning environment, a central design element in E-Lead is the pervasive reliance on meaningful, team-based, real-world projects integrated throughout all four years, serving as the primary vehicle for acquiring both technical content and transferable skills. The scaffolded nature of the curriculum and the project focus foster students' development of intrinsic motivation by giving them opportunities to develop their competence, sense of belonging, and autonomy (Loyens et al., 2008).

To ensure that students see the connection across the levels of impact in the CELD, the curriculum is intentionally integrated, blending technical coursework with lessons on leadership, business acumen, and communication, ensuring skills are applied within real engineering challenges. This design explicitly cultivates a range of essential transferable skills, including leadership, teamwork, communication, innovation, and business understanding, vital for employability and adaptability. Furthermore, the design incorporates robust industry collaborations to provide authentic projects and ensure curriculum relevance to employer needs, with companies specifically seeking out E-Lead students for their leadership potential. Finally, the degree's design encourages students to analyse the comprehensive upstream and downstream impact of their solutions, fostering a broad understanding of their work's effects, and maintains an iterative and adaptive approach, allowing the degree to evolve based on experience and feedback.

4.2 Curriculum and implementation

The E-Lead degree is designed with a strong emphasis on integrating business, leadership, and design throughout all years, primarily achieved through extensive project-based learning. Real-world, team-based projects are central to the curriculum from the first year, serving as the main vehicle for intertwining technical engineering challenges with leadership development and an understanding of business implications. This comprehensive integration extends to business acumen modules that evolve from personal finance to broader business understandings by the fourth year.

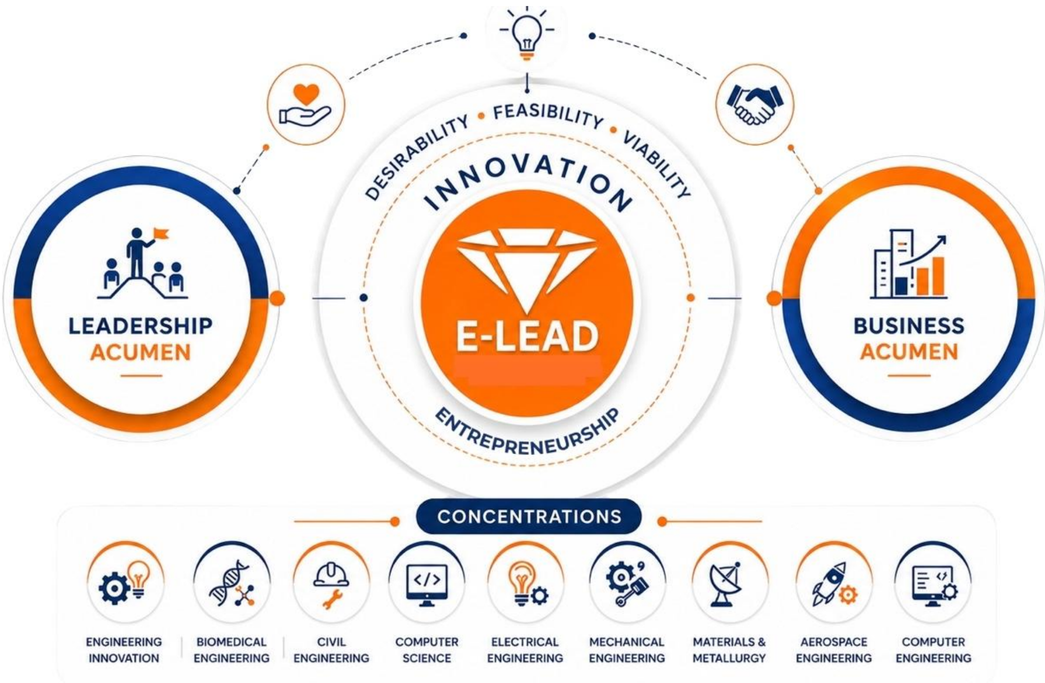

Figure 4.10.1: Illustration of E-Lead structure developed by the Engineering Education and Leadership department at UTEP. Copyright UTEP 2026, used with permission, no further use allowed.

Because this programme is housed in a college of engineering at an established university and accredited as a general engineering programme, the degree was designed to make use of existing coursework and satisfy university and accreditation requirements, while maintaining a coherent thread of modules to tie the material together. Therefore, every student completes a required university core that covers basic science, mathematics, and the humanities. Each student selects one of nine engineering concentrations, corresponding to a range of engineering disciplines; each concentration consists of a prescribed set of modules offered by the disciplinary department (Fig. 4.10.1). The content of the university core and engineering concentration modules is integrated with leadership, business, and innovation in the eight E-Lead modules and two professional practice modules. Depending on the student's selected engineering concentration, they may also have additional emphasis or elective modules that they can select to help round out their knowledge and skills in alignment with their career goals and complete their degree requirements.

In the E-Lead core modules (Table 4.10.1), we scaffold intentional content and skill development throughout the required coursework. In the first year, incoming students focus on acclimating to university life and the E-Lead environment while building a community and gaining foundational design, mathematics, and communication skills. Leadership development emphasizes building emotional intelligence and leading themselves with accountability to peers and instructors. This focus corresponds to the development of self and effectual behaviour at the centre of CELD. In the second year, as students move from a focus on individual to team leadership development in CELD, students begin to experience the power of engineering to impact the world by using the engineering modelling process to explain, predict, or otherwise manipulate the behaviour of systems around them. Through the modules in the second year, students begin working more explicitly on teamworking skills as they generate models, design experiments, and validate their assumptions about the engineered world. In the third year, students expand on the modelling and measurement skills that they have developed to consider the impact of the technology they design on users and social systems. This is the beginning of the shift from focusing on teaming and beginning to move toward tangible impact in their community and society through understanding the context of their engineering work; the final circle of CELD. This is accomplished using two lenses: first, a user-centred design project focused on the needs of an individual client, and second, a lean startup engineering entrepreneurship project focused on the needs of a broader customer segment. Consequently, teams are learning and practicing key engineering leadership skills of vision creation, conflict resolution, and project management. They are also being explicitly introduced to business concepts, including finance, accounting, and marketing, as they consider a viable business model for their engineering startup.

In the final year, students complete a year-long capstone experience. In their capstone projects, students apply their integrated knowledge and skills that have been developed across all previous years in the curriculum. A defining element of the capstone experience is connection to industry through projects that are sourced from industry partners. This focus on industry-driven projects ensures that students develop skills directly relevant to employer needs and prepares them for the transition into their careers. The degree aims to develop engineers who are technically capable while also possessing the other professional skills that are necessary for immediate professional contribution. The scaffolded structure of the degree with corresponding CELD integration is further illustrated in Fig. 4.10.2.

Table 4.10.1: List of E-Lead-specific modules across the curriculum (UTEP, n.d.)

Year and primary CELD emphasis	*Autumn module*	*Spring module*
	Engineering innovation and leadership	**Fundamentals of leadership, design and graphics**
Year 1: Effectual behaviours at the individual level	Through this module, students will gain engineering foundational knowledge of innovation, technological, and leadership advancement in modern society, develop principles of personal, professional, and social responsibility for living in a diverse world, and intellectual and practical skills that are essential for all learning.	This module equips students with fundamental skills to help thrive during the pursuit of their BSc in Engineering Innovation and Leadership. Therefore, a major focus of the module is to help students develop their own identity as leaders and as engineers. Another focus of the module is to build community and culture within the programme. Further, this module introduces students to the flipped classroom and project-based learning styles common in E-Lead modules. The final focus of this module is the development of critical engineering graphics skills for students.
	Modelling and simulation	**Engineering measurements**
Year 2: Teaming	This module introduces the use of difference and differential equations in the modelling of systems with examples drawn from the life and natural sciences, engineering, and business. Computer simulations are developed using programming in Python. Topics also include leadership theories and practices.	In this module, students learn some of the basic tools for making physical measurements and conducting experiments with electric circuits. Topics include the fundamental laws that govern the operation of electric circuits, along with formal techniques associated with the analysis and design of electric circuits. Professional communication skills are developed via formal laboratory reporting. Readings on leadership character and integrity are included.

Year and primary CELD emphasis	*Autumn module*	*Spring module*
	People to Products	**Products to People**
Year 3: Teaming & community /society	This module covers all basic concepts of systems engineering. The objective is to provide the basic knowledge and tools for transforming an operational need into a well-defined system configuration, through an iterative design process of issue formulation, analysis, optimization, design synthesis, system integration, and testing.	This module is the second in a two-module sequence on developing innovative start-ups. It is intended to give students an opportunity to experience the human-centred commercialization process from start to finish in a single semester. In teams, students will move from a functional prototype to a business model that prepares them for a go/no-go decision. It requires students to conduct empirical experimental through interviews with people in their start-up's ecosystem, to recognize the impacts of the start-up on the ecosystem, and to function effectively on teams.
	Capstone design 1: Definition and exploration	**Capstone design 2: Develop and evaluation**
Year 4 : Contextual awareness and bringing it all together	This module is the first semester of a two-semester capstone module in Engineering Innovation and Leadership. The module particularly focuses on preparing and implementing a project design. Engineering innovation and leadership skills are applied to build a cohesive team and to successfully execute a real-world project.	This module is the second semester of a two-semester capstone module. Engineering innovation and leadership skills are applied to execute a successful real-world project.

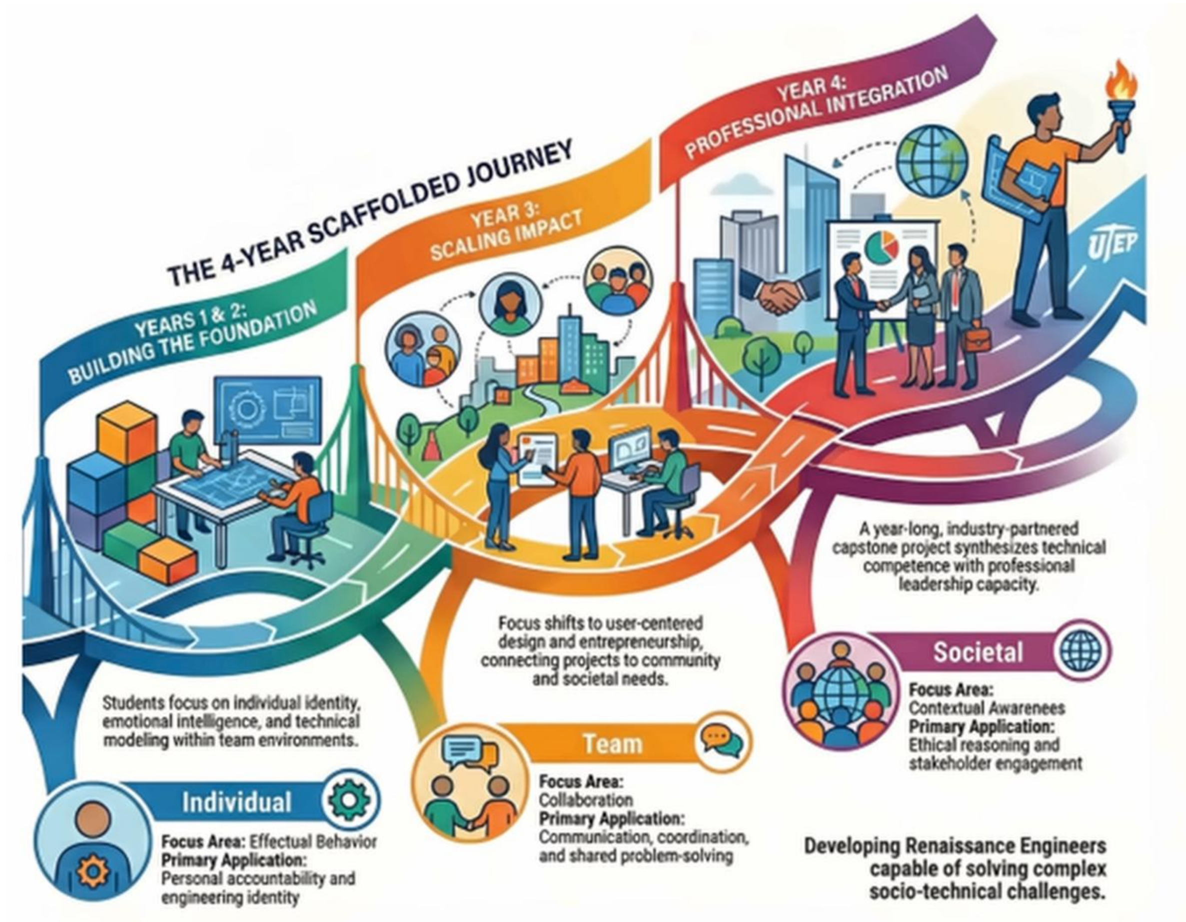

Figure 4.10.2: Illustration of the four-year scaffolded journey with CELD integration developed by the Engineering Education and Leadership department at UTEP. Copyright UTEP 2026, used with permission, no further use allowed.

Finally, the degree includes professional practice requirements, which highlight the consistent emphasis on real-world application and industry relevance, particularly in later years. Students are required to complete two 320-hour summer professional practice experiences, the equivalent of a full-time internship during the summer or working part-time during the school year. These can include internships, co-operative learning experiences, other work experiences, research, or teaching experiences. These experiences allow students to reflect on and apply skills gained in the E-Lead programme, such as leadership, engineering, business, etc.

Example 1. People to Products module project

In the third year of the E-Lead curriculum, students complete a user-centred design project in the People to Products module that emphasizes teamwork and community engagement while developing contextual awareness of engineering practice. This project also provides students with ample opportunities to exercise their own effectual behaviours while managing schedules, navigating conflict, and communicating with stakeholders. Teams partner with a local non-profit; currently *the module educators maintain a partnership with an organization that provides early intervention services to children under the age of three with developmental delays. For this collaboration, students design adaptive products tailored to the needs of individual client families. Students work in teams of four or five that are assigned based on best practices for teamwork, such as avoiding isolation of underrepresented demographics and considering schedule alignment. The students follow a human-centred design process that includes understanding client needs, generating and refining design concepts, building functional prototypes, and validating designs through user interaction and testing. Teams were required to meet multiple times with both an assigned mentor from the partner organization and their client family, integrating their stakeholders' feedback throughout the semester as their designs evolved. The culminating experience is an on-campus event during which teams deliver their products to the client families and present their work to the client families, partner organization staff, programme educators, and peers, emphasizing both technical justification and responsiveness to user needs.*

Assessment in the project is intentionally multimodal and aligned with the module's dual emphasis on engineering design competence and contextual awareness. Staff assess student work across the semester using structured rubrics applied to intermediate and final deliverables, including design definition artifacts, prototypes, and testing reports. Technical assessment focuses on the appropriateness of the proposed solution, use of an explicit engineering design process, and product quality, with particular attention to how teams translate user needs into quantified design specifications and validate performance through modelling and testing. User-based assessment is conducted during the final event using a dedicated client rubric, which evaluates the teams' demonstrated understanding of the child and family needs, the relevance of the proposed solution, product quality based on observed use and feedback, and the effectiveness of communication during the presentation.

Example 2. Capstone module sequence

The two-semester, industry-partnered capstone design project integrates technical knowledge, leadership development, and contextual awareness. A typical project is sponsored by an external industry or community organization and framed around an authentic, open-ended engineering design problem with economic and operational constraints. Teams of three to five students work with a dedicated industry mentor with supervision by module educators to define the problem, explore design alternatives, and develop and evaluate a feasible solution over the academic year. Teams are self-organizing; students commonly assume functional roles such as technical lead and documentation lead. The only required role is the project manager, who is nominated by a team-directed process and approved by the module staff. This structure supports students in practicing effectual behaviours at the individual level — such as initiative, self-awareness, and reflection — while *coordinating technical and interpersonal work within the team and engaging with external stakeholders whose needs and constraints shape the design context.*

The capstone module sequence intentionally targets leadership development across the CELD domains. Individually, students are required to reflect on their learning and leadership growth through structured written reflections. At the team level, students develop collaboration, communication, and project management skills by negotiating roles, managing conflict, and aligning technical decisions with shared goals and timelines. At the societal level, teams are expected to consider the broader impacts of their designs, including ethical responsibilities, economic feasibility, and downstream effects on users and partner organizations.

Assessment includes evaluation of technical deliverables (e.g., design reports, prototypes, validation results), peer and self-assessment of teamwork and leadership behaviours, and feedback from industry mentors. Together, these assessment methods reinforce the capstone as a culminating experience that synthesizes technical competence, leadership capacity, and contextual judgement, preparing students for professional engineering practice beyond graduation.'

4.3 Impact and outcomes

Alumni from the past decade have provided positive feedback about E-Lead and offered suggestions for improvement through a combination of focus groups and surveys.

Programme strengths

Alumni were enthusiastic about several aspects of the E-Lead programme. They highly valued the strong community and peer relationships fostered by the programme, which they consider a significant benefit. The curriculum's focus on critical thinking, metacognition, and adaptability was also consistently praised. Alumni felt these skills prepared them to navigate complex and ambiguous professional situations. They also highlighted the value of tangible resources, such as access to professors, internships, and professional practice opportunities.

Areas for improvement

While the feedback was largely positive, several areas for improvement were identified. The most prominent concern was the programme's marketing and branding. Alumni noted that the name Engineering Innovation and Leadership is confusing and hinders recruitment and career prospects, particularly with recruiters who don't understand the programme's unique value proposition. This lack of clarity also extends to the programme's structure, where the flexibility and autonomy, while appreciated, can lead to confusion and a lack of clear career guidance, especially for international students. Some alumni also debated whether the programme should incorporate more technical skills, such as programming. The second year of the programme, in which students develop their programming and circuits skills, and the need for more structured career support were also highlighted as areas needing review. This stage is pivotal because students are expected to consolidate foundational technical knowledge while beginning to make more informed decisions about their engineering discipline, professional identity, and longer-term career pathway.

Proposed initiatives and actions

To address these issues, alumni proposed several changes. They suggested integrating practical activities like mock interviews into the curriculum to help students better articulate their skills to employers. They also called for a more streamlined degree plan that balances flexibility with clearer guidance. To improve career outcomes, they suggested more dedicated support, including alumni talks and mentorship programmes to help students explore different career paths. The most significant proposal, and one that was divided among alumni, was changing the programme's name to reflect its value better and improve external perception. At the time of writing, there are ongoing conversations about a name change; however, no action has been taken. Other ideas included celebrating student achievements and providing more in-depth education on personal finance and project management across all years in E-Lead.

5 Conclusion

5.1 Lessons learned and recommendations

The E-Lead degree has yielded substantial impacts and outcomes, significantly shaping its engineering graduates and influencing the broader educational landscape. A key outcome for students is the cultivation of well-rounded engineers who not only possess strong technical competence, but also crucial professional skills previously identified as lacking by employers, including improved interpersonal skills, financial understanding, and team leadership. Furthermore, students develop enhanced problem-solving capabilities, learning to think broadly about issues and their immediate and long-term impact, which equips them for complex real-world challenges extending beyond purely technical solutions. The degree's strong emphasis on team-based projects from the outset leads to improved teamwork and collaboration, helping students forge relationships and build robust support structures. This emphasis also contributes to an increased leadership potential, as companies are actively drawn to E-Lead students, recognizing their capacity for leadership in rotational programmes and various industry roles. Ultimately, the practical and project-oriented nature of the degree ensures graduates are highly adaptable to industry needs, making them well-prepared for professional practice with skills directly relevant to employer demands.

Beyond individual student impacts, the E-Lead degree has made significant contributions to engineering education and beyond. It was created with the overarching goal to change what and how engineering is taught nationally, and by pioneering a new model, it aims to contribute to broader reform across engineering education, resulting in UTEP spearheading the Alliance for Integrated Engineering (A4IE), which offers a mechanism for sharing lessons learned, supporting emerging programmes at other public universities. This has positioned E-Lead as a leader within a broader national conversation about integrated engineering education. The degree functions as a flexible and adaptive model for educational innovation within the engineering college, successfully demonstrating alternative pedagogical approaches. The degree also effectively bridges the gap between academic theory and industry practice through its integration of real-world projects and strong industry connections, ensuring graduates are workforce-ready. More broadly, the degree’s ambitious vision is to contribute to national and global innovation and address major societal issues speaking to its long-term societal impact through its graduates, an ongoing challenge. Finally, it contributes to redefining the role of engineering, promoting the perspective that engineering is seen as a foundational skill set needed across many different areas, potentially leading to a wider integration of engineering principles in education.

In terms of recommendations, at the programme level, senior leaders and programme teams play a key role in creating conditions that support meaningful student learning and development. Effective implementation depends on both top-down and bottom-up commitment, supported by the identification of programme champions who can advocate for and sustain the initiative across the institution. Establishing and clearly communicating a shared programme culture is essential for aligning values, expectations, and pedagogical approaches among academic staff and professional services. Processes for monitoring and review should be embedded within existing quality assurance and enhancement structures, with a clear emphasis on ongoing enhancement rather than compliance-driven evaluation. Continued engagement with industry practitioners and alumni networks is also critical, ensuring that curricula remain relevant, informed by professional practice, and responsive to the expectations of employers and professional bodies.

At the module and classroom level, lecturers and teaching staff are central to enacting programme-level aims through curriculum design and pedagogy. Teaching approaches should intentionally incorporate opportunities for reflection, enabling students to consolidate learning and develop a sense of progression across their degree programme. Autonomy and choice should be offered in ways that are appropriately scaffolded across levels of study, supporting students’ increasing independence as learners. The development of transferable and professional skills should be embedded within engineering contexts and aligned with technical learning outcomes, rather than positioned as separate activities. Finally, teaching should be responsive to students’ prior attainment and educational backgrounds, with adjustments to analytical depth and learning expectations that recognise variation in mathematics and science preparation, including those entering via alternative routes.

5.2 Future directions

Looking ahead, E-Lead is focused on refining its identity, strengthening its curricular coherence, and clarifying the pathways students use to connect their integrated engineering preparation with future careers. A near-term priority is to examine how the programme communicates its purpose and value to students, families, employers, and university partners, including whether its current name adequately conveys the technical, leadership, and innovation competencies students develop. This work is closely connected to ongoing review of the degree plan, particularly the second year, where students build foundational programming and circuits skills while beginning to make more consequential decisions about their engineering discipline and professional direction.

Future development will also require more structured career support, including earlier opportunities for students to practise articulating their skills, connect with alumni, understand the range of career pathways available to integrated engineering graduates, and translate project-based experiences into language recognised by employers. At the programme level, E-Lead is likely to continue expanding partnerships with industry and community organisations so that projects remain authentic, technically meaningful, and responsive to emerging workforce needs. E-Lead's next phase is not simply about sustaining an existing model, but about sharpening the programme's identity, improving student navigation through the curriculum, and extending its influence through collaborative programme development.

5.3 Resources and further reading

Finally, in addition to the literature cited in this chapter, we recommend the following resources if you would like to know more about UTEP and its leadership programme: Gonzalez (2025), Joslyn (2022) and Kendall et al. (2018).

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AI statement

During the preparation of this work, the authors used Microsoft Copilot in order to transcribe and summarize group conversations with each author to frame the content of the chapter and develop an image summarizing the degree structure, as well as to synthesize existing module documentation (syllabi, rubrics, assignment descriptions, etc.) to generate succinct summaries of project descriptions and assessment. The authors also used Notebook LM to develop Fig. 4.10.2. After using these tools, the authors reviewed, edited, and made the content their own as needed. They take full responsibility for the content of the publication.

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