Innovation in Civil Engineering Programs

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Abstract

Responding to rapid changes in engineering practice, advances in technology, changes in the education landscape, and expected declines in college enrollment, many civil engineering programs have identified the need to innovate to keep pace with the changing nature of the profession and to continue to attract students. Programs are seeking innovative ways to attract and retain students and to prepare students for engineering practice. As leaders in the civil engineering profession, American Society of Civil Engineers (ASCE) committees have facilitated training and development to advance the civil engineering profession through events such as annual Excellence in Civil Engineering Education (ExCEEd) teaching workshops; education summits in 2019, 2023, and 2025; and annual department head conferences. The CE community has also continuously updated the civil engineering program criteria supporting accreditation through the Engineering Accreditation Commission of ABET accreditation and has led the way among other disciplines by establishing the Civil Engineering Body of Knowledge (CEBoK) which is now developing its 4th iteration. In addition to these ASCE activities, CE programs have capitalized on other initiatives sponsored by the National Science Foundation and the Kern Entrepreneurial Engineering Network.

The objectives of this paper are to characterize innovation in civil engineering programs from the perspective of leaders in these programs and to determine the influence these development, engagement, and program guidance events and documents have had on innovation in civil engineering programs. Methods include a survey of Department Heads (or their program designee) to identify:

- Areas of innovation in civil engineering programs,
- The level of engagement with the ASCE programs and sources of knowledge and motivations for innovation,
- Engagement with industry (including advisory boards) to understand changes in the state of the profession and employer workforce needs,
- Changes made in response to industry needs.

The findings of this study will be of interest to civil engineering programs and to professional societies, including ASCE, to guide programs that support and advance innovation.

Background

Innovation has been defined as "*the process of bringing about new ideas, methods, products, services, or solutions that have a significant positive impact and value. It involves transforming creative concepts into tangible outcomes that improve efficiency, and effectiveness, or address unmet needs*" [1]. Civil engineering programs are innovating in response to rapid changes in technology and the engineering profession, changes within universities, and changing characteristics and expectations of students and faculty. Programs have advanced curricula, recruitment strategies, organizational structure, faculty development, and fundraising among other avenues. Besser et al. [2] and Yelamarthi and Powell [3] describe innovative approaches to attract and retain students and to promote student success. The Kern Entrepreneurial Engineering Network (KEEN) program focuses on developing faculty to foster an innovative and

entrepreneurial mindset in faculty, and as a result, to develop these skills in students [4] [5]. A scan of current headlines in the Chronicle of Higher Education or Inside Higher Ed on most days indicates that universities and programs are identifying innovative responses to budget cuts, funding shortfalls, and other university-level or external pressures.

Curriculum innovation in engineering is essential so that graduates are prepared to address challenges and advance their disciplines, to serve society, and to promote sustainability. Programs also need to develop new ways to attract and recruit students and to support students to foster success in their academic and professional careers [6] [7]. Considering changes in global business practices, new technologies (e.g., artificial intelligence, virtual or augmented reality), and new knowledge generated from research, universities must support students' development of innovation skills (i.e., framing problems and opportunities) as they enter their professions where they will be responsible for developing creative and sustainable solutions. Sustainable design and problem solving skills are necessary to solve societal problems now and in the future [8]. Employers are also recognizing the importance of social and emotional skills, as well as professional skills [9], so that engineers can better communicate with, understand, and meet constituents' needs.

Trends in Civil Engineering Enrollment and Industry Demand

Analysis of data presented by the U.S. Bureau of Labor Statistics, [10] indicates that there are approximately 466,000 civil engineers in the U.S. workforce as of 2023 and that the number of civil engineering jobs is estimated to grow at a rate of 5.04% over the next 10 years compared to the projected overall U.S. job growth of 3.07%. Despite this projected growth in need for civil engineers, interest in pursuing college degrees is declining [11]. Higher education institutions must prepare for, and respond to, the highly anticipated enrollment cliff facing many states in the U.S. Due to the financial stresses occurring during the Great Recession, families had fewer children [12]. Based on U.S. Census data of births from 2008 to 2014, Ford and Rokooei [13] estimate nearly 400,000 fewer expected high school graduates were born during those years, which could lead to approximately 240,000 fewer college freshmen from 2026 to 2031, when those children turn 18.

Further changes include economic and family factors that resulted in population shifts in the United States, where some families moved from the mid-west to the south and southeast regions. These changes, in addition to changing perspectives on the value of a college degree [14], have reduced demand for higher education around the country, with pronounced changes in certain states. Nationwide, the college-going population is expected to drop by 15 percentage points between 2025 and 2029, but enrollment in colleges in the mid-west and east coast states is expected to decrease by more than 15 percentage points [12].

Welding [15] synthesizes data from the National Center for Education Statistics (NCES) that illustrate these changes, showing the number of college students increasing steadily from the 1970s to 2010 but subsequently falling. For example, the period from 1985 to 2010 saw an increase of 2.2% per year on average, but between 2012 and 2022, the number of college students declined at a rate of 1.4% per year.

To offset the loss in college-bound and college-age students, engineering professional societies, engineering programs, colleges, and foundations have sought to attract students to engineering with K-12 outreach activities and the incorporation of engineering in K-12 curriculum standards. While some engineering disciplines have well-established programs at the K-12 level (e.g., FIRST robotics) or are more visible to K-12 students (e.g., personal electronic devices and toys), civil engineering projects and opportunities can be more difficult to convey, even though attracting students to the profession is no less important. The combination of fewer U.S. undergraduate students, job growth for civil engineers that outpaces overall U.S. job growth, and competition for attracting students among the STEM fields leads to concerns about having enough new civil engineers to meet the projected demand. Thus, innovation in curricula and in recruitment and retention programs will become even more important to attract students to engineering programs and emphasize the value, rewards, fun, and importance of careers in civil engineering.

Trends in Civil Engineering Degrees Awarded

The National Center for Education Statistics tracks degrees awarded by program. The number of undergraduate civil engineering degrees awarded in the U.S. by academic year between 1999 and 2021 are presented in Figure 1, which shows an increasing trend in civil engineering degrees awarded. Although not captured in Figure 1, enrollment in CE may be affected by movement to/from other closely-related disciplines such as environmental engineering, construction engineering, and many others. The American Society of Engineering Education (ASEE) [16] reports 12,678 BSCE degrees conferred in 2022 which is a decline from the more than 14,000 degrees awarded annually from 2018-2021. The upward trend from 2000 to 2021 suggests K-12 outreach, curriculum revisions, recruiting efforts and job demands may be influencing students' decisions to become civil engineers, but these efforts will need to be improved and sustained to continue to attract students into civil engineering.

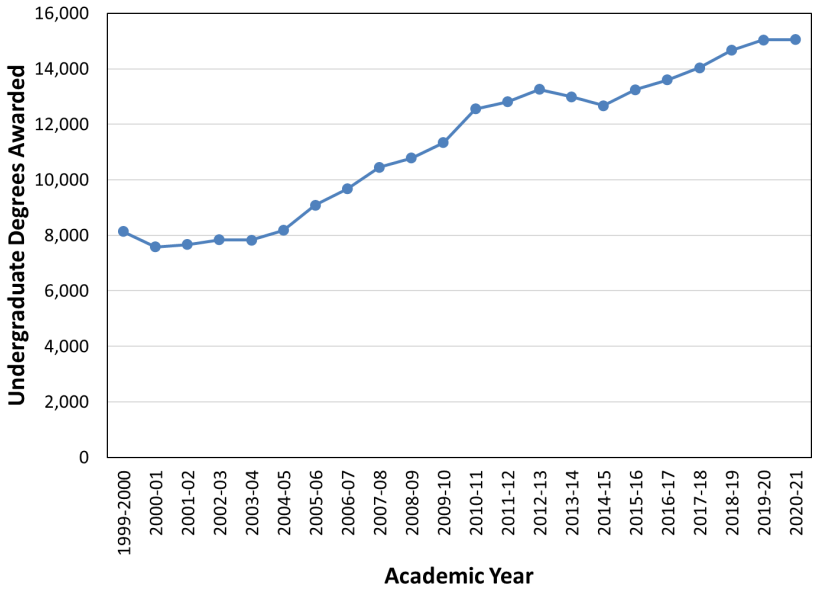

Figure 1: Number of undergraduate civil engineering degrees awarded annually from 1999-2000 to 2020-2021 [16].

ASCE Activities Focused on Advancing the Profession

As leaders in the civil engineering profession, the American Society of Civil Engineers' (ASCE) Committee on Education (COE), Committee on Faculty Development (CFD), and Department Heads Coordinating Council (DHCC) have facilitated training and development to support and disseminate innovative practices to advance the civil engineering profession. Successful initiatives include the ASCE ExCEEd Teaching Workshop, the Civil Engineering Education Summit, and the National Civil Engineering Department Heads Conference.

Focusing on Faculty Development

For over 25 years, the Excellence in Civil Engineering Education (ExCEEd) Teaching Workshop (ETW), a week-long teacher training program sponsored by ASCE, has prepared faculty for effective teaching [17]. From 2021-2025, 181 faculty have participated in the ASCE ExCEEd Teaching workshop. Assuming these 181 ETW graduates teach four courses per year with an enrollment of 20 to 50 students per course, an estimated 14,480 to 36,200 students will benefit in a given academic year. ExCEEd participants learn how to engage students in their learning and to innovate in their classrooms both from a pedagogical perspective and by including civil engineering innovations in the curriculum. A quick review of the ASEE PEER paper system shows that over 3,000 publications have been published at ASEE national and regional conferences related to the ExCEEd teaching model. A review of these papers affirms that civil engineering educators are supporting lesson, course, and curriculum innovation. The publications also demonstrate that faculty are disseminating their innovations at regional and national ASEE conferences and meetings. The Civil Engineering Division of ASEE is the most prescribed division for disseminating best teaching practices and innovation in civil engineering education.

Project ExCEEd was launched in 1998 in response to the need for a faculty development workshop identified at the first ASCE Civil Engineering Education Summit, held in 1995. Recognizing the positive influence of the ExCEEd initiatives and the need to advance civil engineering education, the second Education Summit was co-hosted by the ASCE Committee on Education and the DHCC in 2019 and focused on mapping a course for civil engineering innovation in education [18]. ASCE hosted Education Summits in 2023 (Empowering Innovation) and 2025 (Industry + Academia Sparking Innovation in Civil Engineering Education) [19], bringing together educators and practitioners to exchange ideas and to advance initiatives for innovation.

Focusing on Sharing Best Practices

The ASCE DHCC represents the interests of the education community and leads initiatives to foster communication and collaboration within the civil engineering education community. Among these successful initiatives is the annual National Civil Engineering Department Heads Conference (NCEDHC), which has been in existence for over 20 years, and serves as a forum for discussing innovation in engineering education and research. From developing communities of excellence to advancing innovation in courses, curricula, programs, and research, each of these ASCE programs has had far-reaching, positive influences on the education community.

Methods

To characterize innovation in civil engineering programs, the authors followed two primary paths. First, the authors examined attendance at ASCE sponsored events designed to disseminate knowledge and foster collaboration. Participation in these events provides an indication of the profession's dedication and commitment to innovation. The Civil Engineering Education Summit, ExCEEd Teaching Workshop, and NCEDHC were considered.

Second, the authors designed the survey presented in Appendix A. The survey asked participants to report current and planned innovation efforts, their motivations, resources to support the efforts, and how the engineering education community can better support innovation efforts. The survey was advertised to the ASEE Civil Engineering Division, members of the ASCE Department Heads Collaborate networking site and email distribution list and was intended to be completed by a department's head or designated representative. Personalized requests were also sent to past Department Heads known to the authors. The survey was distributed with York College of Pennsylvania IRB approval (IRB #25FA021).

Results

Participation in ASCE-Led Programs

ASCE staff provided attendance data for the ExCEEd Teaching Workshop (both remote and in-person), NCEDHC, and Education Summits from 2021 to 2025. Annual attendance data for these events are summarized in Figure 2.

More than 550 members attended annual department heads conferences between 2021 and 2025. Notably, the highest attendance for this 5-year period occurred in 2021 where the "conference" consisted of a series of online sessions due to the ongoing pandemic. This observed increase in participation revealed the opportunity to engage a larger proportion of the department heads community by hosting periodic online events throughout the year. In response to this demand, the DHCC has hosted more online events, starting with an annual welcome event typically held in September or October. In academic year 2024-2025, the DHCC also held an online session in February focused on ABET accreditation and a session in April focused on supporting success for women department chairs. Virtual meetings have been found to serve the civil engineering education community on an on-going basis, and they provide a way to reach a portion of the community who may not be able to travel for the 3-day conference, typically held in June.

A CE Education Summit was held at Clemson University (100+ attendees) in April 2023 as part of a National Science Foundation (NSF) Revolutionizing Engineering Departments (RED) Grant. An ASCE-sponsored CE Education Summit (120 attendees) was held immediately following the 2025 NCEDHC at Case Western Reserve University. Although not shown in Figure 2, 167 individuals attended the CE Education Summit at SMU in 2019.

A total of 181 faculty completed the ExCEEd the workshop from 2021 to 2025 with 85 attending in-person workshops and 86 attending remote workshops (ETW-Remote). ExCEEd was conducted only in the remote format in 2021. Due to the popularity and ease of attendance,

remote offerings have continued since 2022, with an average combined attendance of 40 faculty annually attending the remote and in-person workshops.

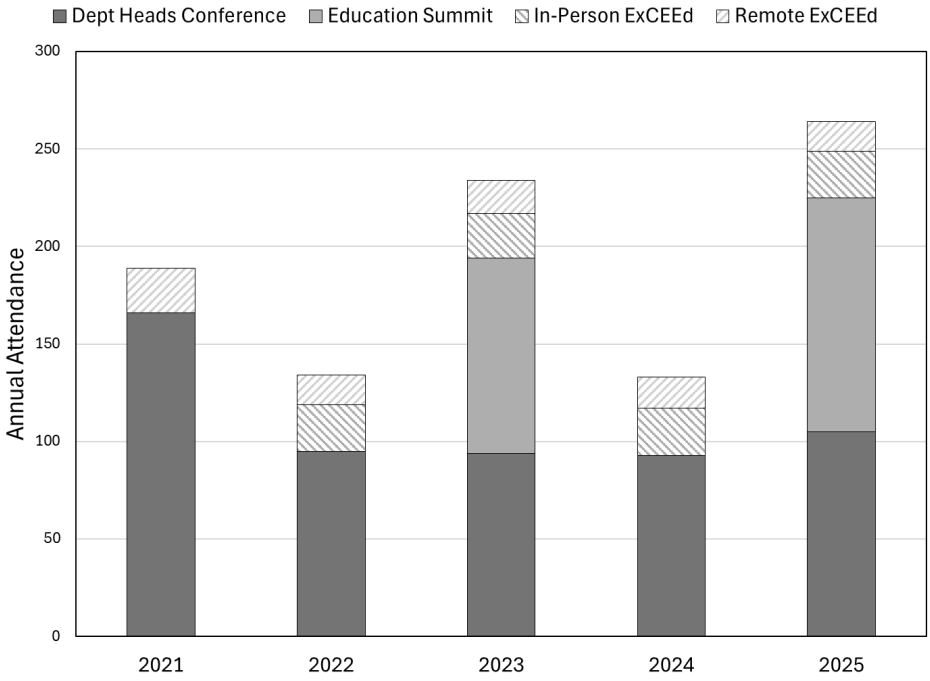

Figure 2: Summary of annual attendance at ASCE leadership, education, and faculty development events.

As of January 14, 2026, the ABET data base shows 278 EAC/ABET accredited Civil Engineering BS programs in the United States [20]. To further understand the impact and reach to the 278 civil engineering programs, Figure 3 contains the number of unique academic programs represented at ASCE annual events. For example, the 166 attendees at the 2021 virtual Department Heads Conference (Figure 2) represented 133 civil engineering programs as shown in Figure 3. Situations where both an incoming chair and the outgoing chair attended the Department Heads Conference are represented by a single entry in Figure 3. Figure 3 also removes registrants from professional organizations (e.g., ABET and ASCE staff) and industry. Synthesizing the information across years, 214 programs (77%) were represented in at least one Department Heads Conference from 2021 to 2025 and 152 (54%) were represented in at least one of the Education Summits from 2019, 2023, and 2025. In addition, 102 programs were represented in the 181 ExCEEd slots. Finally, 261 unique civil engineering programs (over 90%) were represented at an ExCEED or NCEDHC in 2021-2025 or an Education Summit in 2019, 2023, or 2025, which is nearly all of the civil engineering programs in the United States. The ASCE Civil Engineering Education Summits were primarily attended by representatives from academia but practitioners from industry were invited as well. Their perspectives were vital in shaping the recommendations from the Education Summits. Educators and practitioners serving on ASCE committees are working to carry out these recommendations.

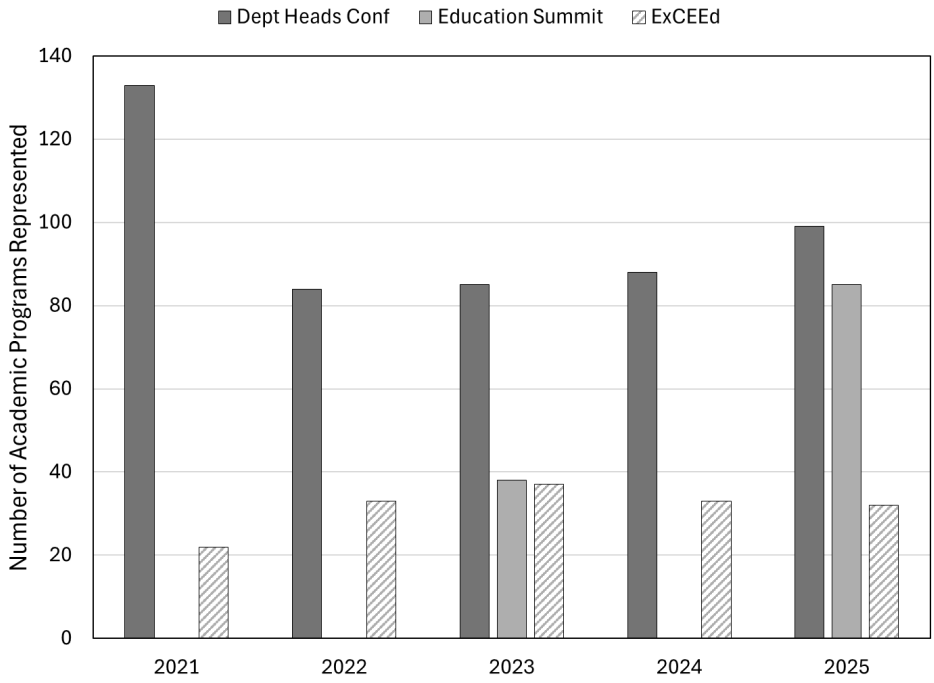

Figure 3: Number of academic programs represented at NCEDHC, Education Summits (2023 and 2025 only), and ExCEEd (includes both remote and in-person).

Survey Responses

A range of engineering and non-engineering disciplines were represented among the survey respondents. Some respondents represented more than one program in their department. Civil engineering (28) and environmental engineering (15) being the most common of the 29 reported responses. All respondents represented four-year institutions, with public PhD granting institutions (19) representing over half of the 29 responses.

Figure 4 provides a summary of responses to the survey question on whether programs have innovated, and if so, where. Nearly all programs have innovated or are in the process of implementing changes within a course (28 of 29), while many have made curricular and program-level changes. The survey questions did not distinguish between innovations at the undergraduate or graduate level. More than half of programs have innovated, are in the process of innovating, or are planning innovation within the areas of faculty development, assessment, program curriculum and course content, facilities, student development, K-12 outreach, and student recruitment.

Figure 5 summarizes the sources of inspiration and knowledge for innovation. The leading source of inspiration and knowledge is through faculty-led efforts. ASCE initiatives such as the CE Education Summits, the CEBoK, ExCEEd teaching workshops, and Department Heads Conference, are also significant sources of inspiration and knowledge to spur innovation.

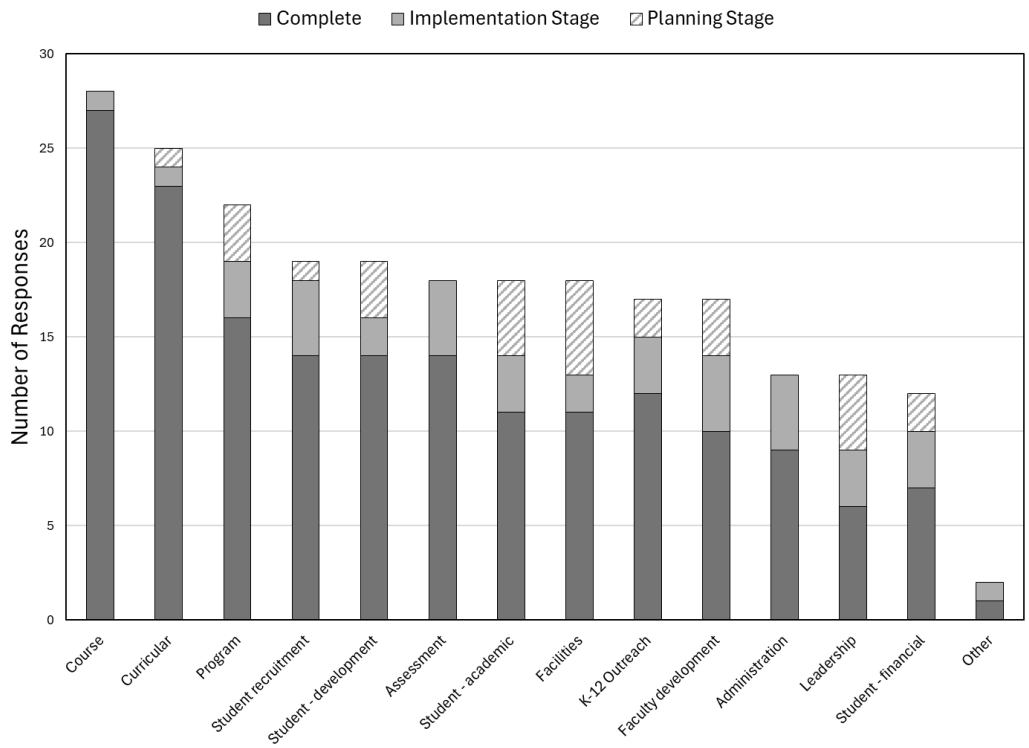

Figure 4: Summary of 29 survey responses on where innovation has occurred and status of the innovation (complete, implementation or planning).

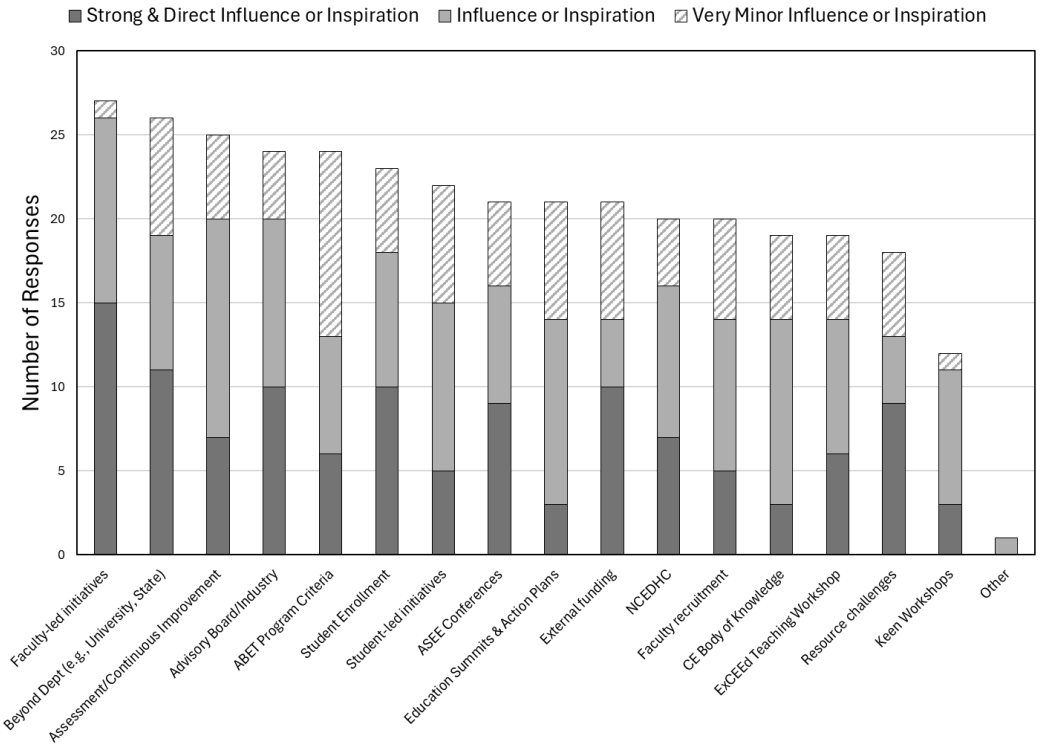

Figure 5: Sources of knowledge and motivation that supported the innovation (n = 29).

Survey Responses (Narrative responses)

Appendix B contains the narrative responses to the survey. Table B1 presents the responses to the survey question "Describe a recent innovation. What was the source of inspiration, motivation, sources of knowledge, implementation, and resources?" The innovations described fit into four categories: Program focused (15 responses), Course focused (11 responses), AI focused (4 responses) and Student Engagement / Success focused (3 responses). Further breakdown of the innovations in these categories are summarized in Table 1.

Table 1. Broad innovation descriptions based on overall innovation themes

Innovation Theme	Innovation Categories (# of responses)
Program focused	● Curriculum changes - new majors, minors, courses, & concentrations (10) ● Attainment of ABET Student Outcomes (2) ● General Education changes (1) ● Study Abroad experiences (1) ● Preparing graduates for licensure (1)
Course focused	● Course-level innovations (4) ● Modifying the capstone / senior design experience (4) ● Broad changes to course delivery strategies (3)
AI focused	● Addition of specific AI focused course(s) (2) ● Integration of AI modules into multiple courses in curriculum (1) ● Creation of BS degree in AI (1)
Student Engagement / Success focused	● Common Book Read for cohort building (1) ● Interactive and Entrepreneurial Learning for student engagement (1) ● Peer tutoring (1)

The motivations for these innovations included faculty interest and workload (4 responses), changes in university structure and/or policy (4 responses); assessment results (3 responses), student feedback (1 response), research (3 responses), looking at other programs' courses (1 response) and industry/advisory board input (5 responses).

Survey respondents were asked how (if at all) has recent interaction with industry or practitioners driven your program's innovation (Table B2). Responses show that industry/advisory boards influence programs' innovation activities. Thirteen respondents (59%) noted a high level of input and engagement and four respondents indicating moderate level of interaction (n=22). Board involvement in the process ranges from providing curriculum content, design projects, feedback on proposed changes, and moral support. Survey responses indicate that advisory boards are important in providing curricular relevance and practical applicability of the curriculum. By

supporting capstone/senior design project content and delivery, advisory boards are directly supporting curricular innovation.

Based on survey responses (n=23), it is clear that program and curriculum innovation occurs in civil engineering programs. When asked what the engineering education community could be doing better to support innovation (Table B3), respondents indicate the need to do a better job recognizing the innovation in our industry through advocacy and communication (9 responses), supporting K-12 education (2 responses), continuing education innovation (2 responses), providing resources (2 responses), facilitating partnerships (2 responses) and reducing department chair roles/responsibilities so they have more time to lead innovation in their program (1 response). Three survey respondents indicated they were not sure or that they were satisfied with our work to innovate in civil engineering programs. One chair responded *"I don't know. As chair I am too overwhelmed by managing the basic necessities to really have time to dig into all the resources that are out there. I've seen lots of good materials produced, but there is little time for me or my faculty to really consider it fully*." Although the quote suggests the chair needs more time for program innovation, it also recognizes the chair is aware of material that exists to support program innovation.

Respondents were also asked to include citations when they have published journal or conference papers that contain additional details on the innovations in their programs. This list of 39 citations is given in Appendix C.

Discussion and Conclusion

Results indicate a high level of engagement and innovation within civil engineering programs. Approximately one-third to one-half of the civil engineering department heads attend the annual ASCE department heads conferences (100 +/- attendees on average), with the highest attendance at the remote conference in 2021, suggesting that continued remote offerings for department heads throughout the academic year could be a way to increase engagement and participation for those who cannot attend the 3-day in-person event. One example of a successful virtual training event was the Committee on Faculty Development workshop in October 2025 titled "Reimagining Civil Engineering Education with Artificial Intelligence" which had approximately 70 attendees.

As shown in Figure 5, over 50% of responses indicate that ASCE-led initiatives including the NCEDHC, the CE Education Summits, the CEBoK, and the ExCEEd programs served as sources of knowledge or motivation for innovation in the program, reflecting the value and far-reaching positive influence of these efforts. Survey responses indicate that innovation is reaching all aspects of the civil engineering education, from seeking to improve courses, curricula, and assessment, to enhancing student recruitment and support. Despite concerns to the contrary, these efforts show that EAC/ABET accreditation criteria, the Civil Engineering Program Criteria, and the CEBoK, among others, appear to be supporting innovation.

Conferences including the NCEDHC, CE Education Summits, and ASEE conferences support innovation by enabling participants to exchange ideas and develop new ones, and to build connections that can lead to advancing innovative initiatives. The Civil Engineering Division of

ASEE routinely has approximately 80 papers and presentations annually at the national conference, in addition to papers and discussions at regional conferences, e.g. ASEE's Zone IV conference theme for 2026 is "Developing Tomorrow's Workforce in the Age of AI and Emerging Technology" [21].

Survey responses showed that many innovations were faculty-led. Civil engineering curricula contain foundational courses to prepare civil engineering graduates [22], but a review of paper topics presented at the ASEE Annual Conference Civil Engineering Division technical sessions in any given year clearly shows that faculty-led innovation within courses is advancing students' technical and professional skills [23] [24], that courses are being taught in new ways [25] [26], and that cutting-edge technology and current issues are being successfully integrated into courses [27] [28].

Civil engineering faculty and departments have also been highly successful at pursuing external grants to support innovation. Of 39 NSF RED grants awarded since 2015, five have gone to civil and/or environmental engineering programs [29]. These programs have shared innovations with the broader community through the NCEDHC, Education Summits, and ASEE conferences [30].

ASCE initiatives continually seek improvement and innovation. ASCE volunteers and staff are in the process of updating the 4th iteration of the CEBoK developed since 2004 [31, 32, 33] and are considering new outcomes necessary to stay ahead of changes in the rapidly changing profession. The ASCE Journal of Civil Engineering Education (JCEE), formerly called the Journal of Professional Issues in Engineering Education and Practice, has expanded its reach over recent years and emphasizes submittals on case studies to share innovative pedagogy in a timely way.

Narrative responses and engagement in the CE Education Summits indicate that industry advisory boards, industry ties, and interactions with practitioners in courses such as capstone, have helped drive innovation in departments.

Department heads' responses to the survey questions, together with projects and publications advancing innovation clearly demonstrate that civil engineering programs are innovating at all levels, using many sources of support and inspiration, and in ways that are relevant to their programs and their students. Equally important, the breadth of publications and significant engagement in ASCE-led programs show that the civil engineering education community is actively learning and sharing lessons learned with the broader community to advance the profession.

References

[1] N. Jain, "What is Innovation? Definition, Types, Examples and Process," 15 July 2023. [Online]. Available: https://ideascale.com/blog/what-is-innovation/. [Accessed 14 January 2026].

[2] D. Besser, K. Acton, J. E. Holte and K. Nepal, *BOARD # 415: NSF S-STEM: Expanded non-traditional pathways to engineering excellence,* Montreal, 2025.

[3] K. Yelamarthi and E. A. Powell, *Engineering Student Support 2.0: A Blueprint for Recruitment, Retention, and Success,* 2024.

[4] M. Carnasciali, A. L. Gerhart, H. Dillon, J. Tranquillo, G. R. Gaudette and D. E. Melton, "Faculty Development for Faculty Development – Taking Entrepreneurially Minded Learning Faculty Development to Your Campus," *Proceeding of 2025 ASEE Annual Conference & Exposition,* 2025.

[5] M. D. Lovell, C. Carroll, M. K. Swenty, C. Riley and D. W. Johnstone, *Civil Engineering and the Entrepreneurial Mindset – Cultivating Teaching Practices that Enhance Entrepreneurial Minded Learning.*

[6] S. C. Brink, M. de Hei, E. Sjoer, C. J. Carlson, E. Keller and W. Admiraal, "Curriculum Agility principles for transformative innovation in engineering education," *European Journal of Engineering Education,* vol. 50, no. 3, pp. 455-471, 2025.

[7] A. Kamp, Engineering Education in the Rapidly Changing World: Rethinking the Vision for Higher Engineering Education, TU Delft Open Books, 2023.

[8] H. Kopnina, "Education for the future? Critical evaluation of education for sustainable development goals," *The Journal of Environmental Education,* vol. 51, no. 4, pp. 280-291, 2020.

[9] J. Scheerens, G. v. d. Werf and H. de Boer, Soft Skills in Education: Putting the Evidence in Perspective, Springer International Publishing, 2020.

[10] "Civil engineers," 2025. [Online]. Available: https://datausa.io/profile/soc/civil-engineers. [Accessed 19 January 2026].

[11] S. Simone and E. Christopher, *Future Education Expectations of High School Students Decline to the Lowest Level in 20 Years for Both First-Generation and Continuing Generation Student,* 2025.

[12] A. Schuette, *Navigating the Enrollment Cliff in Higher Education,* 2023.

[13] G. D. Ford and S. Rokooei, *University Student Enrollments during the next Decade,* 2024.

[14] R. Fry, D. Braga and K. Parker, "Is a College Degree Worth It in 2024?," 23 May 2024. [Online]. Available: https://www.pewresearch.org/social-trends/2024/05/23/is-college-worth-it-2/. [Accessed 19 January 2026].

[15] L. Welding, "U.S. College Enrollment Decline: Facts and Figures| BestColleges," 13 March 2025. [Online]. Available: http://www.bestcolleges.com/research/college-enrollment-decline/#. [Accessed 19 January 2026].

[16] "Degrees in chemical, civil, electrical, and mechanical engineering conferred by post-secondary institution by level of degree, academic years 1999-2000 through 2020-2021," [Online]. Available: https://nces.ed.gov/programs/digest/d22/tables/dt22_325.47.asp.

[17] S. Ressler, A. Estes, C. Saviz, B. Barry, C. Considine, D. Coward, N. Dennis, S. Hamilton, D. Hurwitz, T. Kunberger, T. Lenox, T. Nilsson, L. Nolen, J. O'Brien, R. O'Neill, D. Saftner, K. Salyards and R. Welch, "The ASCE ExCEEd Teaching Workshop: Assessing 20 Years of Instructional Development," *International Journal of Engineering Education,* vol. 35, no. 6A, pp. 1758-1786, July 2019.

[18] K. D. Hall, D. G. Linzell, B. S. Minsker, J. F. Hajjar and C. M. Saviz, Education Summit: Mapping the Future of Civil Engineering Education, Reston, VA: ASCE, 2020.

[19] J. Ogle, E. Nagy, D. Ural, J. Caicedo, A. Ramsburg, J. Sloan, C. Saviz, C. J. Bolding and L. Nolen, "Industry + Academia: Sparking Innovation in Civil Engineering Education," ASCE, Reston, VA, 2025.

[20] ABET, "Accredited Programs," [Online]. Available: https://amspub.abet.org/aps/name-search?searchType=institution.

[21] "Save the Date: 2026 ASEE Zone IV Conference," [Online]. Available: https://ceng.calpoly.edu/connection/2026/01/save-the-date-2026-asee-zone-iv-conference/. [Accessed 20 January 2026].

[22] M. K. Swenty and B. J. Swenty, *A Comparison of Civil Engineering Curriculum and EAC-ABET Civil Engineering Program Criteria,* 2024.

[23] S. Wu, M. Kang and J. Cleary, *Case Study of Integrating Standards, Codes, and Specifications into Engineering Curricula: Various Pathways to Professional Readiness,* 2025.

[24] M. L. Matthews, S. Koloutsou-Vakakis and A. S. Stillwell, *CASE STUDY: Project-based integration of societal context with engineering communication and computational thinking in an upper-level civil and environmental engineering course,* 2025.

[25] A. Battinstini, *Development of a Dramatic Story Plot and Adventure Racing Activities within an Undergraduate Reinforced Concrete Design Course (Work In Progress),* 2025.

[26] J. S. Popovics, Y. Niu, S. Koloutsou-Vakakis, K. Pattaje and J. Henschen, *CASE STUDY: Integration of Python programming in a civil engineering laboratory course.*

[27] A. P. Summerfield, J. P. Voccio, W. C. Kuo-Dahab, B. Ernst and C. Bode-Aluko, *OARD # 52: Integrating Material Focused on Climate Change into Existing Courses in a Civil Engineering Degree Program.*

[28] C. Cercone, K. A. Mendrinos, M. Volovski, J. Lee, M. Fathi, M. Omidvar and S. Quayyum, *Leveraging AI-Generated Supplemental Videos to Enhance Undergraduate Engineering Education,* 2025.

[29] "National Science Foundation: Revolutionizing Engineering Departments (NSF RED)," [Online]. Available: https://www.nsf-redprojects.org/. [Accessed 19 January 2026].

[30] T. Forin, S. Farrell, H. Hartman, K. Jahan, S. Lezotte, S. Dautle, A. Trias Blanco and T. Bruckerhoff, *Developing Sustainable and Continuing Practices for Diversity and Inclusion in a Civil and Environmental Engineering Department,* 2022.

[31] American Society of Civil Engineers Civil Engineering Body of Knowledge for the 21st Century: Preparing the Civil Engineer for the Future, American Society of Civil Engineers, 2004.

[32] American Society of Civil Engineers. Body of Knowledge Committee, Civil Engineering Body of Knowledge for the 21st Century: Preparing the Civil Engineer for the Future, American Society of Civil Engineers, 2008.

[33] American Society of Civil Engineers. Civil Engineering Body of Knowledge 3 Task Committee, Civil Engineering Body of Knowledge: Preparing the Future Civil Engineer, Third Edition, American Society of Civil Engineers, 2019.

Appendix A - Survey Questions

Thank you for your time and assistance in completing this voluntary survey. Our goal is to characterize the degree of innovation that has occurred in engineering programs over the last 5 years, the motivation for the innovation, the resources employed to support the innovation, and the way programs share their innovations with others. The research team is asking the department head/chair or their designated curriculum representative to complete the survey, which is intended to take approximately 10-15 minutes to complete. You will not directly benefit from participation, but findings may inform ASCE educational entities and leadership and the broader engineering community. All responses will be anonymous and once submitted, may not be withdrawn. We will appreciate your response by January 10, 2026. If you have any questions, please contact Norb Delatte (norb.delatte@okstate.edu), Scott Hamilton (shamilton@ycp.edu), Tanya Kunburger (kunberger@pitt.edu), Audra Morse (anmorse@mtu.edu), David Saftner (dsaftner@d.umn.edu), Camilla Saviz (csaviz@pacific.edu), and Joel Sloan (joel.sloan@afacademy.af.edu). Are you willing to complete the survey?

- Yes
- No

Please check all program(s) included in your department.

- Aerospace
- Architectural
- Biological
- Biomedical
- Chemical
- Civil
- Construction
- Electrical
- Engineering/General Engineering
- Engineering Technology
- Environmental
- Geomatics/Surveying
- Industrial
- Manufacturing
- Marine
- Mechanical
- Nuclear
- Physics
- non-engineering (specify) _____
- other (specify) _____

How would you classify your College or University?

- Public, 4-year, undergraduate, MS, and Doctoral
- Public, 4-year, undergraduate and MS
- Public, 4-year, primarily undergraduate
- Private, 4-year, undergraduate, MS, and Doctoral
- Private, 4-year, primarily undergraduate and MS
- Private, 4-year, primarily undergraduate
- Public 2-year
- Private 2-year
- Other (please describe) _____

Within the past 5 years, where have you innovated in the program?

	Innovated	In implementation stage	In planning stage	Not recently innovated
Within one or more courses (e.g., significant update to include innovative topic(s))				
Curricular (e.g., developed a new course, electives, tracks, and/or capstone)				
Program level (e.g., certificates, minors)				
Faculty development				
Assessment				
Managing program/department				
Leadership				
Student support - academic				
Student support - financial				
Facilities				
Student support - development (e.g., site visits, special programs, co-curricular activities)				
K-12 outreach				
Student recruitment				
Other				

Please indicate all sources of knowledge and motivation leading to or supporting the innovation.

	Strong direct influence or inspiration	Influence or inspiration	Very minor influence or inspiration	Not aware of this being an influence or inspiration
Civil Engineering Education Summits/Summit Action Plans				
Civil Engineering Body of Knowledge (CEBOK)				
ExCEEd programs				
Sessions at ASCE Department Heads Meeting				
ASEE conferences				
KEEN workshops				
Input from the program's advisory board/industry				
Initiatives beyond the department (University-led, College-led, Legislature-driven)				
Department and faculty-led initiatives				
Student-led initiatives				
Assessment-driven continuous improvement				
Response to discipline's Program Criteria				
External funding opportunities (grants, external donors) and/or research				
Program differentiation and student enrollment				
Program differentiation and faculty recruitment				
Resource challenges and pressures				
Other				

Indicate sources of all resources (money and time) received supporting the innovation

- University-level resources
- College-level resources
- Department-level resources
- Outside grants and/or donations
- Individual passion
- Other _____

Describe a recent innovation. What was the source of inspiration, motivation, sources of knowledge, implementation, and resources?

How (if at all) has recent interaction with industry or practitioners driven your program's innovation?

What can the engineering education community be doing better to support innovation?

How have you shared your innovations with others?

- Conference publications (i.e. ASCE, ASEE, etc.). If willing, please share links or citations. The authors will include these references in an appendix.
- Journal publications. If willing, please share links or citations. The authors will include these references in an appendix.
- Workshops or presentations outside the university
- Advisory board
- Workshops or presentations within the university
- Other _____

Appendix B – Survey Responses and Categories

Table B1. Describe a recent innovation. What was the source of inspiration, motivation, sources of knowledge, implementation, and resources?

Survey Response	**General category**
AI in Civil Engineering course proposed and created by individual faculty member. Supported by department, but generally faculty passion project.	New course AI
New Environmental Engineering Minor (open to engineering and STEM students). College streamlined process for establishing minors.	New minor
I commissioned a research productivity study in the department in 2020. I had a sense that our productivity lagged other departments at our institution. The report (completed by a faculty member at another university) confirmed this. We also had a desire to increase the depth of our capstone experience which was formerly a project within a construction management course (Stanford et al. 2020). The solution that we collaboratively decided on as a faculty was to implement a year-long (2 course) capstone experience with tracks for: 1) design-build, 2) design, and 3) research-focused design. Two of the capstone tracks are described by Wambeke (2025a and 2025b). We are also preparing a case history paper for the Journal of Civil Engineering Education to describe this more fully and anticipate submitting a draft of this paper to the journal in early 2026. We did not have any external resources in order to complete this and did it based on individual passion through our continuous improvement process.	Capstone / Senior Design
University level reorganization of academic programs and departments has caused us to heavily innovate with regard to our courses, developing new courses and combining others.	Course revisions New courses
- Entered the world of general education courses that are required for all BS students. Motivation: this allows the opportunity to get the word out about engineering other students on campus. - Reimburse students who pass FE exam for the registration fee. Motivation: donation by alumni.	Expansion to Gen Ed Preparation for professional licensure
New assessment of program student outcomes driven by the recent ABET review	Assessment
no idea	--
In the past couple of years we have changed our Civil Engineering capstone to include students from civil engineering, construction management, engineering technology, and at times mechanical and/or electrical engineering students on the same project. Our inspiration has come from a desire to expose students to multi-disciplinary teams and get a better sense for how they will be working in the industry. Discussions with advisory boards and the teamwork criteria for ABET have helped us to implement this innovation.	Capstone / Senior Design Assessment Advisory Board
Broad-based course transformations across the department to increase focus on active learning in courses -- motivated by university-level initiative, university strategic plan, and NSF grant $.	Course revisions Delivery approach
Innovation is mostly driven by responding to the needs of the profession, student retention and student recruitment.	Industry needs Student retention Student recruitment

We developed a minor in Environmental Engineering based on student input and motivations. The program was developed through faculty interest and experience in industry, and our industry partners.	New minor Collaboration with industry
Implementing sustainability across the curriculum. This was driven by a strategic hire and student support at the department level. We also have implemented a natural hazards thrust that has been driven by NASA and NSF EPSCoR funding.	New concept thread Education connection to research
Over the past five years we have iterated on a required common read and accompanying seminar series for all second-year students in the department (both civil and environmental engineering programs). It was initially intended to be a cohort-building experience for our students, alongside the four introductory courses (nominally taken by all civil engineering students in their fourth semester). As the iterations progressed, we found that it also served ABET student outcomes (2, 3, and 4) though we did not conduct any formal assessments. We chose Anna Clark's book, The Poisoned City, about the Flint Water Crisis as the common read and arranged seminar presentations from Anna Clark and at least two others involved in the situation in Flint or similar lead pipe issues elsewhere. In the two most recent implementations, we also included a panel with local representatives, as the city in which our campus is located also emerged a lead pipe issue. Departmental funds were used to have minimally refreshments for the seminars in which the speakers were remote (Anna Clark and others involved with Flint) and a larger refreshment spread for the local (in-person) panel.	New concept thread Assessment
Develop a structured plan for curriculum enhancement that integrates AI modules into existing courses while maintaining alignment with evolving industry standards. Additionally, evaluate the current course portfolio to identify outdated offerings, with the goal of phasing them out or strategically merging them with related courses when such integration strengthens coherence, efficiency, and interdisciplinary synergy.	New concept thread AI
Funded Senior projects for construction competition; grants for long term pathway establishment for recruitment.	Capstone / Senior Design Recruitment
We recently significantly revised the curriculum based on student, faculty, and Industry Advisory Board feedback and input. Student feedback was obtained from student surveys and senior exit interviews. Resources for this were provided by the department and university through grants to develop or revise new courses.	Course revisions Advisory Board
A Department of Civil & Environmental Engineering embarked on a change journey some years ago to enhance early engagement and augment retention in the undergraduate program. The change initiative aims to develop and graduate more holistic students with an entrepreneurial mindset and to enhance the sense of belonging of students to the profession, school and major. Subsequently garnering external support, the initiative draws from and applies interactive learning and entrepreneurially minded learning pedagogies such as problem-based learning, teaming, story-driven learning, computational development and value sensitive design to engage students early and keep them engaged throughout their undergraduate journey.	Course revisions Delivery approach Entrepreneurial mindset

We are launching a new BS degree program in Construction Management. It was inspired by student interest, a driven faculty member, and our advisory board. We proposed the idea to a past dean but got no backing. Last year we had a change in leadership and the new Dean heartily supported our plan and obtained funding for it from private industry. The University as a whole has provided no support, but the college has. It is largely being implemented by the Dean, the Chair, and two faculty members.	New major Advisory Board
We have numerous recent innovations within our undergraduate degree programs (BSCE/Civil Engineering and BSCNE/Construction Engineering) as well as our MSCE program. The most important one is that we combined the Lyles School of Civil Engineering and the Division of Construction Engineering and Management into one school. Since Summer 2024, we are the Lyles School of Civil and Construction Engineering. We started 4+1 BSCE+MSCE and recently added 4+1 BSCNE+MSCE pathways. We also developed Professional Master's concentrations. We started offering a graduate level technical writing class. In the undergraduate program, we developed a core civil engineering thermodynamics course ("Thermal & Energy Sciences for Civil Engineers"). Our faculty members developed several group-taught 1-credit introductory courses on Smart Cities, Water Engineering, and 3D Printed Materials: Customizing Concrete. We have expanded the 3D printing course recently to a 3-credit course. We started a paid "peer tutor" program to support our students taking core courses. Our faculty continue to develop and offer new short-term study abroad courses with generous scholarship support for all participating Lyles School students (undergrad, grad): "International Perspectives in Water Sciences and Management – India"; "Water and Infrastructure Resilience: Public Health and Extreme Events – UK"; "Engineering in the Southern Cone - Buenos Aires and Patagonia"; "Australian Transportation and Supply Chains", "Evolution of European Transportation Systems and Supply Chains - United Kingdom, Germany, and Czechia"; "Smart Mobility in Europe - Germany and Czechia". We also developed and have been offering one-week summer pre-college civil and construction engineering course for high schoolers: "Developing Tomorrow's Infrastructures" (https://engineering.purdue.edu/CCE/Academics/Undergraduate/Courses/CE299-SummerHS) . We continue to support our College of Engineering course offerings in the First Year Engineering programs as well as in EPICS (Engineering Project in Community Service) courses and VIP (Vertically Integrated Projects) courses. Additionally, recent innovations in certain portions of the BSCNE curriculum have been the continued evolution of curriculum-based experiential learning, particularly through industry-integrated internships and capstone experiences that intentionally blend academic rigor with authentic real-world practice. Implementation has been informed by educational literature, practitioner feedback, and iterative reflection, supported by institutional resources and industry partnerships. In all of these efforts, we are inspired by our students and motivated to provide them with opportunities for their academic and professional experience and growth. These efforts are supported by our School (in-kind and financial), at times by the College of Engineering, as well as by our industry partners, alumni, and donors. While these innovations are delivered	Program revisions New courses Collaboration with industry Student support

by our faculty, they are supported by our academic and administrative staff, and where applicable, by our students (e.g. peer tutors, TAs).	
A new BS degree in AI with a focus on Natural and Built Environment	New major AI
Updated Intro course, changed from 1 to 3 credits, added semester long project. Inspiration was other programs' Intro course sounded more fun than ours & motivation was wanting to increase retention and therefore grad rates. We leaned on faculty expertise, ASEE/ASCE publications, and connections at other universities.	Course revisions
Adding two AI courses and a professional program. Looking at ways to integrate AI throughout the curriculum to solve problems, not just for improve writing.	New course AI

Table B2. How (if at all) has recent interaction with industry or practitioners driven your program's innovation?

Survey Response	**General Category**	**Level of interaction**
Advisory board gives some input.	Advisory Board	Minimal
None.	None	None
Our advisory board was aware of and supportive of the change.	Advisory Board	Moderate
We consistently work to partner with our industry and meet the needs of our constituents.	Industry Ties	High
We have an advisory board that we work closely with.	Advisory Board	High
minor influence	Minimal	Minimal
Not much. We discuss some items for student development in advisory board meetings.	Minimal	Minimal
Discussions with our CE industry advisory board have helped us to implement our multi-disciplinary capstone projects, along with support from people from industry who serve as clients on the projects.	Advisory Board Capstone	High
Advisory board members consistently provide reactions and input into our programs and graduate success.	Advisory Board	High
Primary driver in innovation. Department maintains strong ties to the profession.	Industry Ties	High
We regularly work with industry to develop our introductory courses and our capstone course.	Industry Ties Capstone	High

We are in the planning stages to integrate AI throughout the curriculum and have stronger research initiatives along these lines. Our industry partners have been very vocal about needed these types of efforts in our program.	Industry Ties	Moderate
Our department has an advisory (industry) board that has an annual in-person meeting with faculty and students, but these interactions have not driven our program's innovation. We are currently exploring an innovation in the digital infrastructure space and seek the advisory board's feedback on these planned changes.	Advisory Board (doesn't drive innovation)	Minimal
To maintain alignment with evolving industry standards, our approach incorporates regular input from the department advisory board to ensure curricular relevance and practical applicability. The board meets approximately two to three times per year, with consistent participation from about 20 members. Meetings are organized into three subgroups that focus on targeted discussions and provide structured recommendations. Based on these recommendations, the department develops concrete action items and reviews progress through follow-up discussions in subsequent meetings.	Advisory Board	High
Continuous feedback from job fairs, senior projects, support, curricular advising.	Industry Ties	High
Our Industry Advisory Committee has been an important source of information. They have made suggestions on curricular changes (for example, better integration of software into the curriculum) and reviewed and provided feedback on proposed changes.	Advisory Board	High
We have a highly engaged external advisory board consisting of industry leaders who provide valuable insights to industry trends etc. We have a second board that his solely focused on construction engineering, which has facilitated a resurgence of the construction curriculum within our CE degree over the past decade or so. Finally, we run a vibrant Corporate Affiliates Program that provides another touch point for industry interaction.	Advisory Board Industry Ties	High
We have had very important conversations with advisory board members and local employers of our students that have given us confidence to launch the program and help with the curriculum.	Advisory Board	Moderate
Ongoing interaction with industry and practitioners is a primary driver of innovation in targeted areas of the curriculum. Through regular engagement with the Industry Advisory Board, guest speakers in courses, internship supervisor surveys, and informal but consistent conversations, we gather insight into emerging trends related to workforce readiness and professional expectations. This feedback loop allows us to adjust curriculum and learning experiences to better align with industry needs while maintaining academic integrity.	Advisory Board Industry Ties	High

Our department is very much involved with the external board. Many of the major qualifying projects (MQPs) are industry-supported projects.	Advisory Board Industry Ties Capstone	High
Our industrial advisory board is very active and provides outstanding advice that we implement. Engineers who aren't on our IAB are also very active in the program and participate at the course level through connections with individual faculty.	Advisory Board	High
It has been an influenced as they have specific needs for AI.	Industry Ties	Moderate

Table B3. What can the engineering education community be doing better to support innovation?

Survey Response	**General category**
Provide justification and rationale. Help show how it matters.	Advocate and Communication
Recognize innovations with awards.	Advocate and Communicate
Existing venues of ASCE Dept Heads conferences, ASEE civil division sessions, periodic Ed Summits, and ExCEEd are fantastic.	Advocate and Communicate
Keep sharing successes and failures.	Advocate and Communicate
Get rid of the woke agenda and return to the fundamentals. Incorporate opportunities for students to find different ways to solve problems that are both practical and innovative.	Education Innovation
provide grants/funds to encourage innovation	Resources
I am interested to learn	--
Teaming on large network-based grants that spark change in programs.	Partnerships
None - lots of good advice and resources.	Nothing needed
The primary concern we have is student motivation and competence coming out of the high school environment. Supporting interested in CE at the grade 10-12 level is vital - not enough is being done on this front.	K-12 Support
The engineering education community can provide a dynamic list of the top 10 innovations and technologies in Civil Engineering. The list would include descriptions of each entry, with examples of implementations (whether in civil engineering directly or civil engineering-adjacent) and maybe links to educational materials. The list would be updated every three to five years.	Advocate and Communicate
	--
Elementary, Middle, and High School students often do not understand the difference between engineering and technical programs. In Civil Engineering, there are challenges with the construction industry. Yes, there are many opportunities in construction. But, there are still opportunities in traditional Civil Engineering fields.	K-12 Support

Shift the educational paradigm from answer-focused instruction to question-focused learning. In the current era, AI systems outperform humans in producing answers efficiently, making traditional answer-centric education, which originated during the Industrial Revolution to train engineers to perform predefined tasks correctly, increasingly outdated. Education should instead emphasize the formulation of meaningful questions, problem framing, and critical inquiry, enabling humans to focus on creativity, judgment, and innovation, while AI handles repetitive and time-consuming analytical tasks.	Education Innovation
Open the summit to include remote participation to reduce travel expenses.	Resources
Unsure.	--
Improve culture of value of education innovation and scholarship	Advocate and Communicate
I don't know. As chair I am too overwhelmed by managing the basic necessities to really have time to dig into all the resources that are out there. I've seen lots of good materials produced, but there is little time for me or my faculty to really consider it fully.	Chair responsibilities
The greatest opportunity for supporting innovation in engineering education lies in cultivating the right mindset and culture. When innovation is valued, encouraged, and normalized, it incubates within programs. To sustain this culture, institutions must also provide tangible support through resources, professional development, and space for faculty to experiment, reflect, and iterate without undue risk.	Advocate and Communicate
I believe the lack of focus on innovation in the Civil Engineering community is EXTREMLY concenrging [sic]. Compared to Chemical, Mechanical, Material, Aerospace, and Bioengineering, Civil Engineering is significantly lagging behind in innovation. This is essentially a cultural problem from undergraduate education.	Advocate and Communicate
We have benefited greatly from connections to the engineering education community. Keep up the good work!	Partnerships
Providing examples and documentation of innovation that have been done.	Advocate and Communicate

Appendix C - Citations for the Innovations Reported in the Survey

Amekudzi-Kennedy, Adjo; Webster, Donald; Zerbe, Ellen; Burns, Susan; Hunter, Michael; Melkers, Julia; Blum, Terry; Haas, Kevin (June 2025, ASEE Conferences); BOARD # 264: IUSE: Using Strategic Planning to Drive Curriculum and Cultural Change https://doi.org/10.18260/1-2--55626

Amekudzi-Kennedy, A. A., & Webster, D., & Zerbe, E., & Burns, S. E., & Hunter, M., & Melkers, J., & Blum, T., & Haas, K. (2025, June), *Effective Practices and Lessons Learned in Managing and Sustaining Curriculum and Cultural Change at CEEatGT* Paper presented at 2025 ASEE Annual Conference & Exposition , Montreal, Quebec, Canada . 10.18260/1-2--56319

Andrijcic, E., S. Mohan, E. Litzler, R.J. Han, A. Amekudzi-Kennedy, D. Webster, K. Haas, C. Woolard (2025) Fixing the potholes on the road to academic success: A curriculum for engineering educators to create and sustain meaningful change. Education Sciences 15: 1509 (20 pp.) https://doi.org/10.3390/educsci15111509 Note: This paper appears in an invited issue "Rethinking Engineering Education".

Becker, K.L. and Sloan, J.A. (2023). "Implementing technical communication instruction in a civil engineering course: The value of knowledge surveys and peer review." *J. of Civil Engineering Education*. 149(4): 05023004. https://doi.org/10.1061/JCEECD.EIENG-1927

Bongioanni, V. I., & Christopher, J. D., & Hitt, B. D. (2025, June), Impact of Structured AI Implementation on Student Confidence and Instructor Interactions in an Undergraduate Geotechnical Engineering Course Paper presented at 2025 ASEE Annual Conference & Exposition, Montreal, Quebec, Canada. 10.18260/1-2--56743

Broberg, M. R., & Khalifah, S., & Gupta, A., & Nafakh, A. J. (2021, July), *An Evaluation of a University-Level, High School Course Taught to Foster Interest in Civil Engineering (Evaluation)* Paper presented at 2021 ASEE Virtual Annual Conference Content Access, Virtual Conference. 10.18260/1-2--36666

Broberg, M. R., & Capa Salinas, J., & Wagner, D. N. (2023, June), *A Pre-College Civil Engineering Course: Fostering Interest in Engineering Among High School Students and Developing Future Engineering Educators* Paper presented at 2023 ASEE Annual Conference & Exposition, Baltimore , Maryland. 10.18260/1-2--42460

Broberg, M. R., & Capa Salinas, J., & Khalifah, S. (2024, June), *Lessons Learned through Multi-Year Team Teaching of an Engineering Course for Pre-College Students* Paper presented at 2024 ASEE Annual Conference & Exposition, Portland, Oregon. 10.18260/1-2--47728

Capa Salinas, J., & Broberg, M. R. (2024, June), *Creating a Pipeline of Civil Engineering Students Through Innovative Summer Course* Paper presented at 2024 ASEE Annual Conference & Exposition, Portland, Oregon. 10.18260/1-2--47085

Capa Salinas, J., & Salmeron, M., & Chobe, G., & Montoya, H., & Broberg, M. R. (2024, June), *Evaluation of Transfer of Learning in a Pre-College Engineering Short Course (Evaluation)* Paper presented at 2024 ASEE Annual Conference & Exposition, Portland, Oregon. 10.18260/1-2--47364

Capa Salinas, J., & Salmeron, M., & Montoya, H., & Broberg, M. R., & Sharma, S., & Seo, H. H., & Rojas, J. (2025, June), *Surviving the Storm: An Assessment of Natural Hazards Experiential Learning Activities for Civil Engineering Students Facing a Changing World* Paper presented at 2025 ASEE Annual Conference & Exposition , Montreal, Quebec, Canada . 10.18260/1-2--57172

Frank, T., & DePorres, D., & Stoneham, E., & Sloan, J., & Bongionanni, V., & Tucker, E. (2024, May), Engineering Problem Solving: Implementing a New Foundational Engineering Course Paper presented at 2024 Rocky Mountain Section Conference, University of Colorado, Boulder, CO. 10.18260/1-2-1153-49417

Fulk, Brandon and Hasanzadeh, Sogand (2025) "Bridging Academia and Construction Industry: Insights from Sequential Multi-Internship Experiences," *CIB Conferences*: Vol. 1 Article 115. DOI: https://doi.org/10.7771/3067-4883.1943

Haas, Kevin; Amekudzi-Kennedy, Adjo; Kaiser, Jennifer (June 2025, ASEE Conferences); Applying Aspects of Professional Settings to Student Teaming in an Engineering and Design Course https://doi.org/10.18260/1-2--46591

Haas, Kevin; Muscalus, Alexandra; Zerbe, Ellen; Simon, Robert (June 2023, ASEE Conferences); Applications of Teams and Stories: Augmenting the Development of Entrepreneurial Mindset in Engineers https://doi.org/10.18260/1-2--42274

Leidig, Paul A., Khalifa, Susan M., and Oakes, William C. (2023). "Capstone Design in Engineering Community Engagement Course." *J. Civil Engineering Education*. 149(2). https://ascelibrary.org/doi/full/10.1061/(ASCE)EI.2643-9115.0000071

Okere, G., & Giroux, R. P. (2023, June), *Making the Case for Teaching Construction Contract Changes and Claims as an Elective Course in Construction-Related Programs* Paper presented at 2023 ASEE Annual Conference & Exposition, Baltimore , Maryland. 10.18260/1-2--43529

Pickenpaugh, M., & Sedej, O., & Wambeke, B., & Pickenpaugh, J. (2025, June), Including Leadership in Civil Engineering Education. Paper presented at 2025 ASEE Annual Conference & Exposition, Montreal, Quebec, Canada. 10.18260/1-2--56770

Scharff, L.F., Chandler-Garcia, L.M., Culver, C., Frank, T.E., Post, M., Tetley, J., Sloan, J.A. In Press. "Knowledge surveys: Developing self-assessment, integrating effective learning strategies, and enhancing transparency to support student success." Book chapter accepted for *TILTed Pedagogy: A Collection of Evidence-Based Assignments to Inspire Learning*, Elon's Center for Engaged Learning (CEL) Open Access Book Series. Shannon Sipes, Mandy Frake-Mistak, Jennifer Friberg, Eds.

Simon, Robert; Field, James; Stewart, Lauren (June 2024, ASEE Conferences); Board 39: Increasing Students' Understanding of Stakeholder Perspectives: A Value-Sensitive Design Case Study https://doi.org/10.18260/1-2--43100

Sloan, J.A. and Scharff, L.F. (2022). "Student self-assessment: Relationships between accuracy, engagement, perceived value, and performance." *Journal of Civil Engineering Education*. 148(3): 04022004. https://doi.org/10.1061/(ASCE)EI.2643-9115.0000063

Sloan, J.A., Beauregard, M.S., and Russell, M.M. (2023). "Chapter 4: High impact practices in the civil engineering major at the United States Air Force Academy." *High Impact Practices in Higher Education: International Perspectives (Innovations in Higher Education Teaching and Learning, 51)*. Sengupta, E. Editor. Emerald Publishing Ltd, U.K.

Sloan, J.A., and Frank, T.E. (2023). "Student self-assessment data: an instrument for program assessment" *Intersection: A Journal at the Intersection of Assessment and Learning*, (4)2. DOI: http://dx.doi.org/10.61669/001c.84511

Sloan, J.A., Frank, T.E., Scharff, L.F., and Becker, K. L. "Knowledge surveys: A robust self-assessment tool." *Teaching and Learning Inquiry*, Vol 13(2025): 1-20. https://doi.org/10.20343/teachlearninqu.13.47

Stanford, M. S., & Sloan, J., & Pocock, J. B., & Russell, M. M. (2020, June), A Construction Management Competition as the Basis of a Capstone Culminating Event Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual Online. https://peer.asee.org/33987

Vargas-Ordóñez, C. E., & Santagata, M., & Yu, D. J. (2023, June), *Board 35: Assessing Students' Perspectives and Attitudes Toward Social Justice and Compassion in Civil Engineering (Work in Progress)* Paper presented at 2023 ASEE Annual Conference & Exposition, Baltimore , Maryland. 10.18260/1-2--42980

Wambeke, B. (2025, June), Research-Focused Design Capstone Project: Ultra High-Performance Concrete (Case Study) Paper presented at 2025 ASEE Annual Conference & Exposition , Montreal, Quebec, Canada. 10.18260/1-2--57133

Wambeke, B. (2025, June), Design Build Capstone Project – Pedestrian Bridge (Case Study) Paper presented at 2025 ASEE Annual Conference & Exposition, Montreal, Quebec, Canada. 10.18260/1-2--56225

Wambeke, B., & Sloan, J., & Frank, T. E., & DePorres, D. (2023, June), Student-to-Industry Interaction in a Civil Engineering Field Course: Benefits for Education and Leadership Paper presented at 2023 ASEE Annual Conference & Exposition, Baltimore, Maryland. 10.18260/1-2--44339

Webster, D.R., R.S. Kadel, and W.C. Newstetter (2020) What do we gain by a blended classroom? A comparative study of student performance and perceptions in a fluid mechanics course. International Journal of Engineering Education 36: 2–17.

Webster, D.R., D.M. Majerich, and A.G. Madden (2016) Flippin' fluid mechanics - Comparison using two groups. Advances in Engineering Education 5(3) (20pp).

Webster, D.R., R.S. Kadel, and A.G. Madden (2019) Blended dynamics – Does size matter? In Blended Learning in Practice: A Guide for Practitioners and Researchers (eds. A.G. Madden, L. Margulieux, R.S. Kadel, and A.K. Goel), MIT Press, pp. 213- 245.

Webster, D.R. (2019) Flippin' engineering mechanics! Observations of student achievement and engagement. In Engaged Student Learning: Essays on Best Practices in the University System of Georgia (ed. D.P. Domizi), vol. 1, pp. 26-28.

Webster, D.R. and W.C. Newstetter (2020) Psychological safety by blending in engineering mechanics. In Engaged Student Learning: Essays on Best Practices in the University System of Georgia (ed. D.P. Domizi), vol. 2, pp. 16-18.

Webster, Donald; Amekudzi-Kennedy, Adjo; Simon, Robert (June 2025, ASEE Conferences); Exploring Civil and Environmental Engineering for First-Year Students https://doi.org/10.18260/1-2--56497

Zerbe, Ellen; Amekudzi-Kennedy, Adjo; Haas, Kevin; Simon, Robert; Shaffer, Janece (June 2023, ASEE Conferences); Board 247: Designing Learning Environments for Knowledge, Skills, and Mindset Development https://doi.org/10.18260/1-2--42690

Zerbe, Ellen; Amekudzi-Kennedy, Adjo; Haas, Kevin; Webster, Donald (June 2023, ASEE Conferences). Early Engagement and Vertically-Integrated Learning: Developing Whole-Person and Entrepreneurially-Minded Engineers. https://doi.org/10.18260/1-2--41453

Zerbe, Ellen; Amekudzi-Kennedy, Adjo; Haas, Kevin; Burns, Susan; Russell, Armistead; Tien, Iris; Watkins, Kari; Koon, John; Simon, Robert; Taylor, John; et al (August 2022, ASEE Conferences)

Zerbe, Ellen; Haas, Kevin; Muscalus, Alexandra (June 2023, ASEE Conferences); Incorporating Teamwork Elements into a Course to Improve Learning Outcomes
https://doi.org/10.18260/1-2--43646