Board 112: Creating an Institutional Culture of Empowering Faculty for Student-centered Learning through a Pilot Program

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WIP: Creating an Institutional Culture of Empowering Faculty for Student-Centered-Learning through a Pilot Program

Introduction

The Engineering Enhancements for Student-centered Learning at Tech (ESCL@Te) initiative was established in Fall 2021 by the College of Engineering (CoE) administration collaboratively with a team of faculty to address the current state of instructional practices college-wide. The CoE had undergone a change in leadership with a new Dean in 2019 and an Associate Dean of Academic Affairs in 2021. Building on what the faculty and departments had reported in their ABET Self-Studies during their 2020 accreditation visits, the new administration leaders sought to first understand the existing culture regarding engineering education within this college.

Prior Initiatives

In Fall of 2014, prior college leadership sponsored a six-month internal study conducted by a small team of engineering faculty and administrators. The team performance was guided by the training received in the team alchemy[1] system. Using a process of stakeholder discovery, the team conducted interviews with ten groupings of key external stakeholders. The outcome of the six-month study was a twenty-page summary of interview findings with recommendations for actions categorized in four categories using the change typology presented by Henderson [2]. An implementation team of engineering faculty partnered with education faculty during the subsequent years (2015-2018) to offer short professional development workshops guided by the internal study and its recommendations. Example outcomes of the prior implementation is developing a new model for long-term collaborative faculty development and adopting the COPUS instrument[3] as an observation protocol to help faculty become aware of their instructional strategies for engaging students in the classroom.

Goal/Objectives

The ESCL@Te initiative aims to create an institutional culture of empowering faculty members as scholars of teaching and learning (SoTL) for engineering education to improve the education provided to its students continually. To achieve this goal of empowerment, the initiative has set the following objectives: 1) provide resources and support for faculty to implement research and evidence-based practices for student-centered learning, both inside and outside the classroom; 2) foster a culture of open discussion and sharing of practice among the faculty across and beyond the college; and 3) document improvements in course design and delivery for internal purposes and for public dissemination.

Student-Centered Learning

Student-centered learning (SCL) methods and approaches have been defined and classified in a variety of ways[4], [5], [6], [7]. For the purposes of the ESCL@Te initiative, SCL is defined as learning methods in which the student: assumes a greater participation in the act of learning; recognizes that responsibility for their learning resides with them; and, achieves introduction, exploration, and/or demonstration of success through student actions. The first two characteristics are hallmarks of SCL. The third characteristic is found in most, but not all, SCL methods and is especially applicable to engineering education. Implementations of SCL can be described in terms of level of student participation, ranging from non-participatory to fully

participatory, and individuality of learning, ranging from engaging as an individual learner to engaging in collaborative learning with others.

Faculty Information

The College of Engineering currently has an enrollment of 2700 students, 90% of which are undergraduate students, with a predominant focus on undergraduate education and workforce development. These undergraduate students are enrolled in well-established programs such as chemical engineering, civil and environmental engineering, computer engineering, computer science, electrical engineering, engineering technology, general engineering, and mechanical engineering offered through the seven departments housed within the CoE. These programs are supported by 83 faculty members comprised of 68 tenured/tenure-track faculty and 15 instructors. While many faculty members are interested in engineering education, only 10% are actively engaged in the SoTL. The ESCL@Te initiative seeks to double this faculty participation in the next two years.

Methods

The ESCL@Te initiative offers a sustainable college-level approach to change by acknowledging and leveraging related programs and resources in the university environment.

University Environment

Tennessee Technological University is a public research university with more than 10,000 students located in Cookeville, Tennessee. Tennessee Tech is accredited by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC). SACSCOC accreditation operates in a ten-year cycle that requires its accredited institutions to develop a Quality Enhancement Plan (QEP), which must focus on improving specific student learning outcomes and/or student success. Our SACSCOC accreditation was most recently reaffirmed in 2016 and our QEP, *EDGE: Enhanced Discovery through Guided Exploration,* was designed to enhance student learning by infusing creative inquiry (CI) throughout the undergraduate experience. With *EDGE*, we implemented an integrated curricular and co-curricular plan that enabled our students to develop the skills to formulate CI questions, decide on proper approaches to address them, explore relevant evidence, and produce and present their findings or creations. From 2016-2021, 170 *EDGE* course grants were funded in all eight of our Colleges or Schools for faculty to redesign and enrich their courses with CI projects, to the benefit of an estimated 14,000 undergraduates. Funds were also provided for: 37 faculty development opportunities; 652 students from all eight Colleges or Schools the opportunity to present their work at our annual Research and Creative Inquiry Day; and, 35 students to publish their work in our *Journal of Creative Inquiry* (JCI). Faculty who won *EDGE* course grants attended a multi-day workshop ("Camp QEP") for support in developing their CI course. Camp QEP was hosted jointly by Tech's Office of Creative Inquiry and Center for Teaching and Learning Excellence (CTLE), which was the predecessor to our current Center for Innovation in Teaching and Learning (CITL).

CITL and Workshops

The Center for Innovation in Teaching and Learning (CITL) provides faculty development opportunities, instructional technology support, and instructional design assistance to foster a culture of teaching and learning that is engaged, innovative, transformative, and purposeful. The center utilizes the Online Learning Consortium (OLC) Rubric [8] to evaluate and improve the overall quality of learning experiences based on researched best practices. The CITL hosts an annual Summer Intensive which provides an in-depth breakdown of the OLC rubric and offers opportunities for cross-curricular exchange of ideas. To further professional development university wide, the CITL hosts one-hour weekly sessions each semester to discuss instructional technology and overall pedagogical best practices. During Fall 2022 workshops included information on critical thinking [9],[10], cognitive load [11],[12], Poll Everywhere, group work [13], [14], feedback [15], [16], and engagement strategies.

The CITL facilitates Small Group Instructional Diagnostics (SGIDs) at the request of faculty to give students a chance to voice their suggestions and concerns at the mid-point of the semester. A SGID is a simple and straightforward evaluation process that uses structured small group discussions among students in a class to provide confidential feedback to an instructor[17], [18]. The survey asks students to share what supports or hinders their learning, suggestions to enhance their learning, and a self-reflection question for how students can improve their learning. Small Group Instructional Diagnostics offer an anonymous consensus from students, and faculty can gauge how implementation from their innovative proposals have helped student learning throughout multiple semesters.

ESCL@Te Initiative Committee and Community

The ESCL@Te initiative began with the establishment of a small faculty committee of five members, formed by the Associate Dean of Academic Affairs in Fall 2021. Soliciting early adopters and creating ambassadors for the program, seed funding was provided by the CoE, and the Committee was charged with developing a grant cycle for CoE faculty to apply for funding to implement a student-centered learning project of their choosing in the Summer/Fall of 2022. Information sessions were held in February 2022 to help faculty become aware of this new initiative, specifically for the ESCL@Te Grants ($5000/each) application process. Nine applications were received in mid-March 2022 (two from computer science, three from civil engineering, one from mechanical, and three from engineering technology). The Committee evaluated the two-page applications, and with minor revision, eight of the nine were accepted. Of the eight, five were successfully implemented during Fall 2022. The other projects were delayed due to changes in teaching assignments. In the latter part of Fall 2022, the applicants were encouraged to share current status of their projects during an open lunch meeting hosted by the College. A second cycle of funding was opened in late Fall 2022 for implementation in Spring/Summer/Fall 2023. Nine applicants were reviewed, and eight were selected for funding in this second cycle. Recipients of the $5000 ESCL@Te Grants funding are expected to meet a minimum set of requirements:

- Attend a minimum of two seminars/workshops offered by the CITL in the semester following funding selection.
- Work with the CITL staff to implement the curriculum improvements in the grant cycle period

- Collect quantitative and qualitative data to assess the impact of the new curricular or co-curricular implementations.
- Submit a report at the end of the academic year with the implementations, lessons learned, and plan for the future.

To gain momentum and build further awareness throughout the College, the Committee is expanding the initiative to focus on community building in year 2. The initiative now hosts monthly ESCL@Te Community lunch meetings (first Wednesday). These monthly meetings are open to all CoE faculty. Establishing a regularity of meetings is important to gain traction with all the competing time requirements on faculty schedules. During the community meetings, faculty members share current practices, updates from ongoing projects, and challenges faced in newly funded projects. These dynamic meetings are highly interactive, with questions and suggestions, and sharing of concepts and research in SoTL. Each semester, we will be hosting multiple external speakers of distinction to learn from their experiences, facilitate an idea exchange, and to create new collaborations. Typical attendance in these community meetings has more than doubled from 5 to 12 over a period of one year. We are adopting a strategy from the music department when they host guest performing artists, having a public engagement event as well as master class offerings. Our engineering interpretation on this approach is to have our speaker of distinction offer a 45-minute interactive lunch talk for all faulty, accompanied by multiple small sessions of group interaction, with a limited number of participants to promote deep discussion.

To ensure ease of access to shared resources, the initiative is also building a Microsoft (MS) Team ESCL@Te Community site, where internal reports on the initiative projects can be shared along with reading suggestions from engineering education literature. Such a site also allows for asynchronous conversations to occur between the monthly community meetings, where faculty can start a channel of communication or respond to a peer's query.

Findings and Next Steps

The CITL and the CoE conducted a needs assessment survey in February 2022 with nine initial responders and a subsequent re-release yielded secondary 24/83 or 29% response rate, with participants from six of the seven CoE departments. Based on the survey findings, the CITL provided two ESCL@Te initiative specific workshops in Summer 2022. The one-hour, interactive sessions were delivered in a hybrid environment where instructors discussed the importance of students taking an active role in the classroom and incorporating activities where learners engaged with the content, the instructor, and their peers. In addition, six CoE faculty attended the two-day CITL hybrid workshops called Summer Intensives held in May 2022.

After the implementation of ESCL@Te initiative and the hiring of a CoE specific instructional designer, participation of CoE faculty with CITL events has increased significantly. In Fall 2021, three CoE faculty attended 4 of the 15 workshops offered by the CITL. In Spring 2022, eight CoE faculty attended 12 of the 16 workshops offered. In cycle one funding, eight recipients met with the CoE specific instructional designer in the CITL during Summer 2022, at least once. One of the eight recipients leveraged the expertise and support from the instructional designer to a greater extent. Additionally, five ESCL@Te initiative grant recipients attended the Student-

Centered Learning workshop in July 2022 and six recipients attended a workshop on Active Learning in August 2022. Out of the 13 total SGIDs conducted by the CITL in Spring 2022, 10 were engineering courses (6 individual professors, including one ESCL@Te initiative faculty recipient). In Fall 2022, of the 15 total SGIDs conducted, six were in engineering courses, on behalf of three individual CoE faculty.

As we continue the ESCL@Te initiative, we will be formalizing our measures of success. Beyond tracking numbers of CoE attendees at CITL events and ESCL@Te Community meetings or faculty applicants and recipients for ESCL@Te initiative funding, the committee will be setting metrics during Spring 2023. These metrics will be collaboratively developed with input from the ESCL@Te Community established with the two cycles of funding.

References:

[1] T. J. Laurence, "Team Alchemy – the Chemistry of Successful Teams," pp. 1–12.

[2] C. Henderson, A. Beach, and N. Finkelstein, "Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature," *J. Res. Sci. Teach.*, 2011, doi: 10.1002/tea.20439.

[3] T. Daher, W. Babchuck, L. Perez, and L. Arthurs, "Exploring Engineering Faculty Experiences with COPUS : Strategies for Im- proving Student Learning Exploring Engineering Faculty Experiences with COPUS : Strategies for Improving Student Learning Abstract Few studies have examined engineering faculty use," 2018.

[4] J. Froyd and N. Simpson, "Student-Centered Learning Addressing Faculty Questions about Student- centered Learning," *Curric. Labor Improv. Conf.*, vol. 30, no. 11, pp. 1–11, 2008, [Online]. Available: http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.526.348.

[5] M. Weimer, *Learner-Centered Teaching: Five Key Changes to Practice*. John Wiley & Sons, 2013.

[6] K. Kaput, "Evidence for Student-Centered Learning," *Educ. Evol.*, no. January, pp. 1–28, 2018, [Online]. Available: https://files.eric.ed.gov/fulltext/ED581111.pdf.

[7] J. D. Bransford, A. L. Brown, and R. R. Cocking, *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*. 2000.

[8] H. Kathuria and D. W. Becker, "Leveraging Course Quality Checklist to Improve Online Courses," *J. Teach. Learn. with Technol.*, vol. 10, no. 1, pp. 400–407, 2021, doi: 10.14434/jotlt.v10i1.31253.

[9] D. Kurnia Tari and D. Rosana, "Contextual Teaching and Learning to Develop Critical Thinking and Practical Skills," 2019, doi: 10.1088/1742-6596/1233/1/012102.

[10] K. D. Tanner, "Promoting student metacognition.," *CBE Life Sci. Educ.*, vol. 11, no. 2, pp. 113–120, 2012, doi: 10.1187/CBE.12-03-0033.

[11] B. Oakley, B. Rogowsky, and T. Sejnowski, *Uncommon sense teaching: practical insights in brain science to help students learn*. TarcherPerigee, an imprint of Penguin Random House LLC, 2021.

[12] M. Bleich, "Helping Leaders Learn - ProQuest," *The Journal of Continuing Education in Nursing*, 2016. https://www.proquest.com/docview/1844060150/fulltextPDF/339E0B2CF5494F60PQ/1?a

ccountid=28833 (accessed Feb. 13, 2023).
[13] R. Ellis and F. Han, "Assessing university student collaboration in new ways," *Assess. Eval. High. Educ.*, pp. 1–16, 2020, doi: 10.1080/02602938.2020.1788504.
[14] A. Fjelkner-Pihl, "'Ok—I Need Help from Somewhere': 'The Educational Value of Multiplex Student Relationships in a Commuter College,'" *Innov. High. Educ.*, vol. 48, no. 1, pp. 83–104, Feb. 2022, doi: 10.1007/S10755-022-09611-Y/TABLES/4.
[15] T. Ryan, M. Henderson, K. Ryan, and G. Kennedy, "Designing learner-centred text-based feedback: a rapid review and qualitative synthesis," *https://doi.org/10.1080/02602938.2020.1828819*, vol. 46, no. 6, pp. 894–912, 2020, doi: 10.1080/02602938.2020.1828819.
[16] W. R. Mcgowan and R. T. Osguthorpe, "Student and Faculty Perceptions of Effects of Midcourse Evaluation," doi: 10.1002/j.2334-4822.2011.tb00629.x.
[17] D. J. Clark and M. V. Redmond, "Small Group Instructional Diagnosis: Final Report," pp. 10–20, 1982, [Online]. Available: https://www.academia.edu/27875374/Small_Group_Instructional_Diagnosis_Final_Report?auto=download.
[18] B. Black, "Using the SGID Method for a Variety of Purposes," *To Improv. Acad.*, vol. 17, no. 20210331, 1998, doi: 10.3998/tia.17063888.0017.019.