

Re-designing a Technical Communications Course to Address Scaling Challenges

Dr. Jennifer Retherford, University of Tennessee at Knoxville

Dr. Retherford is an alumna of the University of Nebraska, Omaha, and received her graduate degrees from Vanderbilt University. She currently teaches a variety of courses supporting the department of Civil & Environmental Engineering at the University of

Dr. Sarah Mobley, University of Tennessee at Knoxville

Sarah J. Mobley is a Lecturer in Civil and Environmental Engineering at the University of Tennessee, Knoxville. She holds a Bachelor of Science in Civil Engineering from the University of Alaska, Anchorage, as well as a Master of Science in Geotechnical Engineering and a Doctorate of Philosophy in Structural Engineering from the University of South Florida, Tampa. Sarah is a registered professional engineer in the state of Alaska where she worked as a staff engineer for the Department of Natural Resources. She has been a faculty member at the University of Tennessee since the Fall of 2019 where she serves as a laboratory specialist in the fields of materials, geotech and structures. Sarah mentors students by serving as an advisor for the student chapter of the Society of Women Engineers.

CASE STUDY: Re-designing a Technical Communications Course to Address Scaling Challenges

Technical communication courses are part of the core curriculum for many civil and environmental engineering programs, and scaling of these courses is both necessary and challenging. Technical communications courses focused on writing and speaking require a significant grading effort. Students entering these courses have widely varied knowledge bases, often are not confident in their writing abilities, and typically have negative opinions towards the need for professional communication skills. Personalized feedback for writing assignments is essential in the development of the student writers, but the open-ended nature of the assignments and the many variations of “correctness” in the written products compounds the grading process. Programs experiencing undergraduate population growth may recognize technical communications courses as less “scalable” than computational-based courses. The amount of effort to grade additional papers and presentations is noticeably greater than the additional capacity needed to grade engineering analysis and design styles of homework. At the University of Tennessee, the Department of Civil & Environmental Engineering is restructuring their technical communications course to address current and future “scaling” concerns. The proposed method for course modifications adopts the ASCE ExCEEEd Teaching Model strategies for new course design, recommends a team-teaching approach, and promotes traits comparable to a flipped classroom structure.

INTRODUCTION

Technical communication courses offer students quality professional skills development, but the content is often considered unique to the computational coursework offered through many other standard courses in the civil engineering undergraduate curriculum. Teaching demands in these courses are heightened as they require comprehensive individualized feedback which is more time-consuming to generate than numeric solutions to analysis and design problems. Thoughtful refinement of course design is necessary to address grading demands in these types of courses for programs growing or predicting growth. The American Society of Civil Engineers' Excellence in Civil Engineering Education (ASCE ExCEED) Teaching Model provides a framework for course design supported by scholarship reinforcing concepts such as quality delivery of content, appropriate use of in-class and out-of-class time, and effective design of assessment materials. Although the ExCEED Teaching Model was applied in the current course design, refinement using the Model was required to address the nearly 100% increase in enrollment experienced in the class in the 2024 Spring semester. The following paper outlines a case study applying the ASCE ExCEED Teaching Model to refinement of a sophomore technical communications course at the University of Tennessee at Knoxville.

CASE STUDY GOAL

The design of this technical communication course (CE205) intentionally integrated several aspects of the ExCEED teaching model but increasing enrollment has subsequently increased the student faculty ratio (SFR) and impeded the faculty's ability to fully implement many of those elements. Figure 1 shows the total course enrollment from the Fall of 2019 through the current semester. The trendline shown displays an exponential trend in the increasing number of students forecasting continued enrollment growth. As designed, CE205 follows a modified flipped classroom with one day of lecture supplementing online learning materials and a second day of workshop where students work in small groups under the guidance of faculty and teaching assistants to apply key elements of the week's lesson. There are no writing prerequisites for this course and as such students enter the course with widely varied knowledge bases. Meeting the educational needs of a varied knowledge base requires individualized attention which can only be achieved with the level of engagement made possible with a low student to faculty ratio (SFR.) The Association of English Departments' (AED) policy on class size and workload for university instructors of English recommends a maximum enrollment of 20 students in a single instructor writing course [1]. For application in this case study, the AED policy has been interpreted as a maximum SFR of 20:1, used as a course redesign goal. The enrollment at the time of course redesign in Fall 2020, allowed for a SFR of 18:1 (shown in Figure 2) with (1) faculty facilitator and (2) graduate teaching assistants but current and projected enrollment has nearly tripled the SFR consequently undermining the implementation of the course design. This study examines methods of refining and restructuring the CE205 course design with the goal of maintaining a low SFR and high levels of engagement.

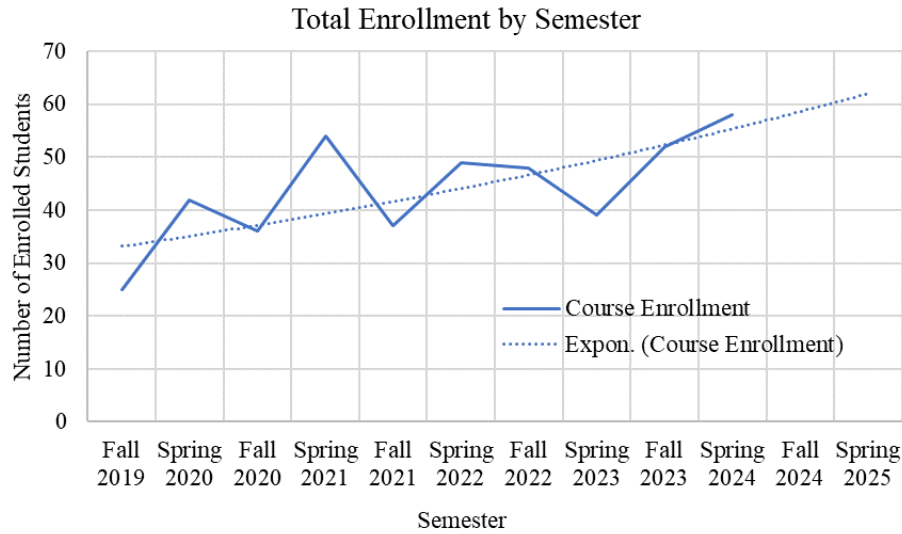


Figure 1 CE205 Student Enrollment Fall 2019 to Present

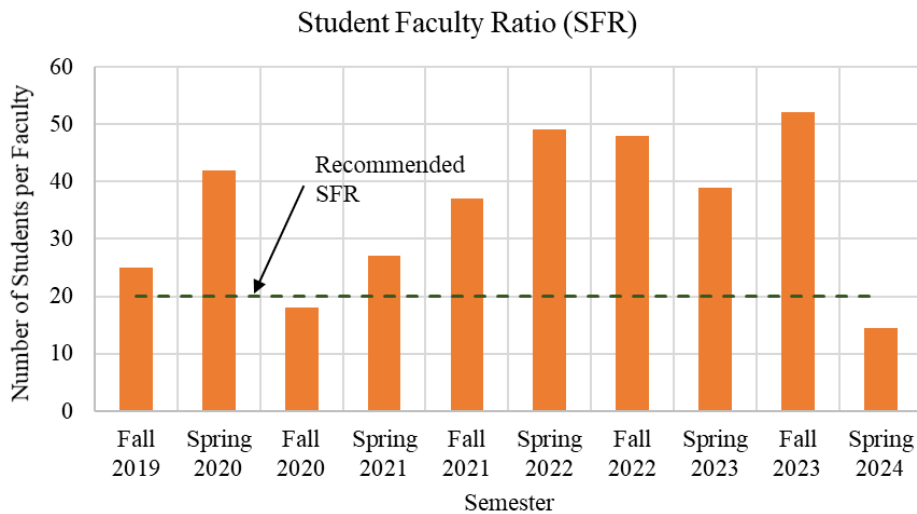


Figure 2 CE205 Student Faculty Ratio Fall 2019 to Present

METHOD

ASCE's ExCEED Teaching Model was selected as the primary framework to review and redevelop the CE205 course. The ExCEED Teaching Workshop is well established in the civil engineering discipline and has offered pedagogical training to over 1,000 junior faculty for (25) years [2]. The model has been adopted at a wide variety of university types, by a variety of educators of different faculty assignments, and across many different types of civil engineering courses [3], [4], [5], [6], [7]. Recent modernization efforts resulted in refinements to the workshop and corresponding content seminars, but the core scholarship of the program was recognized by external reviewers as high quality. The Model was designed by a team of educators dedicated to developing a systematic mechanism to train new individuals in a time-efficient manner, but the Model was later evaluated and recommendations for the application of the Model were expanded. While the Model initiates at the design of a single class session, the concepts of the model apply just as well to the

design of a module in a course, the design of an entire course, design of a sequence of courses, and ultimately to the design of an entire curriculum. For this paper, (4) components of the Model were prioritized in deliberately guiding the upgrades of the course mindful of intentional changes all seeking to improve the quality of both teaching and learning.

Structured organization & appropriate use of technology

The technical communications course (CE205) required minimal refinement related to structured organization compliant with the ExCEED Teaching Model's Structured Organization criteria. The course's learning objectives were reviewed and confirmed to align with the course assignments and weekly lesson content designed for the course. The course is taught in a partially flipped classroom format comprised of (3) specific components: out-of-class content delivery, in-class content delivery, and in-class "workshops". In this 2-credit hour course, one day each week is dedicated to a lecture during which the professor delivers a lesson with enhanced explanation of content offered to the students online. In their second weekly meeting, students apply the lessons in an active workshop format. In-class lecture materials and asynchronous content offered to students through the learning management system (LMS) were reviewed and learning objectives for these modules were confirmed to align with the course learning objectives. The flipped classroom format offers opportunities to engage students through a variety of learning style preferences as the class experience includes some passive listening experiences, many active learning experiences, discussions varying from global concepts to more directly applicable concepts being transferred directly to their graded work. Ultimately, the course was considered well-structured and the strategy for delivery was not manipulated in the course redesign.

Engaging presentation & positive rapport

The refinement of CE205 was considerable with respect to maintaining a high level of engagement and positive rapport. The course "workshop" days have been considered a critical element in student success as they improve the connection between the principles being taught in the class while also offering a space to develop positive rapport. The course requires students to author two papers, each of which is revised once during the semester. In the assessment process, students receive verbal comments which need to be addressed in the revision and positive rapport is essential in maintaining high morale as students adapt to the fundamentals of technical communication. In the recent past, one day each week (workshop days) allowed students to work in small groups which resulted in a student to faculty/graduate teaching assistant (GTA) ratio of approximately 10:1. Through deliberate rotations, the students have opportunities to engage on a personal level with all the members of the grading team, which has improved student reception towards the feedback offered in the written reports. Maintaining a low student to faculty/teaching assistant ratio was considered essential in the refinement of the course and an increase in the grading team size was sought. In Spring 2024, (2) professors, (1) 20-hour/week GTA, and (3) 10-hour/week undergraduate teaching assistants (uGTAs) have been assigned to manage two sections of the course which has an enrollment of (57) students. During weekly class sessions, the student to faculty/TA ratio will be maintained at approximately the same 10:1 status.

Enthusiasm

Enthusiasm has been an exciting element of the CE205 course design and deliberate effort to maintain high enthusiasm was not challenging. The CE205 course requires sophomore students to develop technical reports and technical presentations. The course does not have a strong positive reputation among students as many students struggle, especially so early in their academic training, to find a quality value in adopting the skills being presented in the course. With emphasis on engineering analysis and design, enthusiastic delivery of content in the course is essential in encouraging students to accept the professional skills being

developed. The course design already promotes a sense of community and entry into the “CEE family” and some lesson content helps support the excitement of joining our academic program and exploring the discipline areas contained within the broad civil and environmental engineering profession. In the current refinement, enthusiasm was revisited and will be maintained by balancing the teaching demand between (2) professors.

Assessment of student learning

Assessment of student learning required revisiting the systems used by the grading team to deliver quality feedback in a time-efficient process. The course design was reviewed to ensure continued alignment with ExCEEd Model concepts such as appropriate alignment between assessment tools, course lessons, and learning objectives; these did not require refinement in adjusting the course to the new enrollment demand. The greatest attention was paid to the grading effort for the technical reports which require the most time from the grading team. The technical reports require the grading team to score according to grading rubrics, provide written comment feedback, and complete the process in approximately 1-week to allow students sufficient time to complete their revision work. In the previous design, the rubric was sub-divided based on distinct categories and each member of the grading team was assigned specific categories. For example, a grading rubric might have points related to use of appropriate references and correct formatting of in-text citations; these two categories might be assigned to the same GTA, making them an ‘expert’ in these categories of the grading process. Through this assignment process, each member of the grading team is responsible for reviewing every single paper and grading the unique rubric criteria. The grading remains consistent as each individual focuses on a particular technical writing principle and the feedback is often stream-lined as some common comments can be offered to many students experiencing the same misconceptions or misunderstandings. The number of members of the grading team was increased so we could further sub-divide grading rubrics, maintaining ‘experts’ in specific categories of the rubrics, allowing everyone on the grading team to visit every paper, and avoiding a considerable increase due to the increased number of papers being submitted for grading review.

CASE STUDY OBSERVATIONS

The changes in course design and delivery in CE205 have made an immediate impact on the student experience through increased contact with the instructional team. The semester prior to implementation, CE205 had a SFR of 53:1, more than two and a half times the recommended upper limit. Moving the course from a single facilitator to a team-teaching model and splitting the course enrollment into two sections brought the ratio down to 13:1, leaving room for projected continued enrollment growth. A comprehensive Learning Management System (LMS) page was released at the start of the Spring 2024 semester, and the value of visually representing the course structure has been useful in managing the large class. Through deliberate reference to the LMS at the beginning of most class sessions, students are encouraged to engage with the platform frequently and recognize the course design sequence. Overcoming challenges of communication in the large enrollment through appropriate use of the LMS has allowed the team to use class time to discuss new ideas more than answer questions related to course structure. The current SFR allows for the high level of student engagement required to address the challenges associated with delivering technical communication curriculum. Positive rapport has been more easily attained because of the reduced SFR and the introduction of a department-focused writing center. Enthusiasm from the grading team has been positively integrated into small group discussions with the students and the energy has encouraged more participation in the writing center. If the current enrollment trend continues, the course will require additional sections or instructors by Spring 2027, but the framework established is resilient in supporting enrollment growth. Time dedicated to assessing student work was reduced from Fall 2023 to Spring 2024 through the co-taught framework. The adjustment to a more manageable SFR reduced the

grading effort by nearly half, but better aligns the effort with an appropriate pacing to consistently deliver quality, relevant, and individualized feedback on the technical writing. Defining the required SFR for the course means the department and university owe a responsibility to the faculty assigned to the class. Future increases in enrollment, bringing additional tuition dollars, should result in grading team growth paced with student population growth.

SUMMARY & FUTURE WORK

Priorities in the refinements of our technical communications course focused on retaining quality interpersonal rapport with each individual student while maintaining academic rigor in the communications course. Through the (4) major categories of the ExCEED Teaching Model, the course was refined to address the considerable increase in enrollment in the course. Changes influenced by the Model included refining a flipped classroom modality, hosting workshops with smaller sections of the larger course population, deliberately encouraging engagement in the department's writing center, and maintaining quality assessment by introducing the co-taught style. Students have adopted the content on the LMS and participation in class shows comfort and energy. The grading team has successfully maintained quality assessment and provided feedback in a rapid pace with special care to support student uncertainty in performance. The Model is being evaluated throughout the Spring 2024 semester but shows signs of being capable of expansion should enrollment push the SFR towards the recommended limit we offer herein. Future work includes incentivizing visits to the Writing Center to encourage more timely and thoughtful conversations about writing assignments. Additionally, the faculty continue to explore opportunities for students to interact across courses so the relevance of the lessons towards future coursework can be better recognized by the students.

REFERENCES

- [1] “ADE Guidelines for Class Size and Workload for College and...,” Modern Language Association. Accessed: Feb. 06, 2024. [Online]. Available: <https://www.maps.mla.org/Resources/Policy-Statements/ADE-Guidelines-for-Class-Size-and-Workload-for-College-and-University-Instructors-of-English-A-Statement-of-Policy>
- [2] A. C. Estes *et al.*, “The ASCE ExCEED Teaching Workshop: Assessing 20 Years of Instructional Development,” *Int. J. Eng. Educ.*, vol. 35, no. 6, pp. 1758–1786, 2019.
- [3] C. Riley, S. L. Beaudry, and A. Bettencourt-McCarthy, “An Institutional Excellence in Teaching Workshop Adapted from the ExCEED Model,” in *2018 ASEE Annual Conference & Exposition*, 2018.
- [4] A. Morse, “Application of the ExCEED Teaching Model to Improve Graduate Teaching in Environmental Engineering Courses,” in *2009 Annual Conference & Exposition*, 2009, p. 14.223. 1-14.223. 18.
- [5] S. D. Hart, “Applying the ExCEED Teaching Model in a Flipped Classroom Environment,” in *2016 ASEE Annual Conference & Exposition*, 2016.
- [6] J. Q. Retherford and J. K. Amoah, “Incorporating ASCE’s ExCEED Principles in Capstone Project and Other Active Learning Courses,” in *Proceedings of the American Society of Engineering Education Southeast Section Conference*, 2014.
- [7] R. W. Welch and C. B. Farnsworth, “Using the ExCEED Model for Distance Education,” in *2011 ASEE Annual Conference & Exposition*, 2011, p. 22.1645. 1-22.1645. 22.