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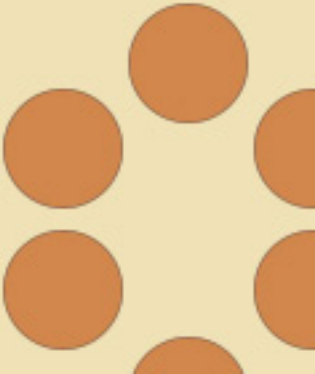

CPTSC

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Collaboration Models for Programmatic Development: Stakeholder Engagement in Program Design, Growth, and Assessment

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As we note in the call for proposals for this special issue (Lancaster, 2022), in the last 13 years, every archived issue at the time of the CFP has included the word stakeholder—over 450 uses for the term, with 80% appearing in archived issues since 2015. Stakeholder engagement is more than a trend; it is a vital part of the practice of technical and professional communication (TPC), and thus of program development, as TPC instructors seek to teach their students to collaborate with stakeholders and model collaboration by *exemplum*. The nature of technical, scientific, and professional communicators is collaborative (Beck, 1993), and that nature is acknowledged throughout the literature. Research and theory has addressed collaboration with students in graduate and undergraduate programs (e.g., Balzhiser et al., 2015; McKee, 2016; Steiner, McCracken, & Moeller, 2020) and with professionals in various fields (e.g., Bosley, 1995; Hill & Griswold, 2013; Lofstrom, 2010). The field have also published literature that addresses stakeholder collaboration as it relates to assessment (Clegg et al., 2021; Kinash, McGillivray, & Crane, 2017; Say, 2015); industry advisory boards (Spartz & Watts, 2016); and curriculum development including client-based projects (Kramer-Simpson, Newmark, & Ford, 2015; Lancaster & Yeats, 2016), service-course curriculum (Ballard, 2018; Schreiber, Carrion, & Lauer, 2018), and course materials (Carnegie & Crane, 2019; Oswal & Meloncon, 2017). This list addresses only a small segment of the literature that TPC scholars have published.

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Despite the innateness and the emphasis in scholarship for collaboration, our field's primary journals have not published a special issue focused on TPC, stakeholder engagement, and collaboration. Additionally, our field is sparse on highlighting formal collaboration models that TPC uses in stakeholder engagement. This is the motivation behind our special issue of *Programmatic Perspectives*.

Despite the collaborative thread that is woven through the essence of TPC, collaboration is not natural; it requires planning, strategizing, evaluating, communicating, and revising. In TPC, we must seek out others to collaborate in developing programs, courses, and projects. We must establish and maintain relationships, build connections and trust, and establish networks that benefit stakeholders in our program designs. Our stakeholders are innumerable:

- Industry contacts and advisory boards benefit in helping to ensure that our students graduate with skills that meet employers' needs; they also benefit from investing in their community, including institutions of higher education—with input, internships, and projects.
- Colleagues on campus benefit from collaborative relationships and from working with students, either in service learning or in diverse learning experiences, to help diversify student skills and also to gain student services in the learning process.
- Administrators and accreditation boards benefit from stakeholder input—for taking education beyond "the walls" of the classroom, preparing better educated graduates, building strong programs, and ensuring that curriculum is relevant and appropriate.
- Industry and government sponsors of research and program labs benefit by working with TPC practitioners and scholars for efficient and valuable investigation and development.
- Students benefit from experience with professionals and learning in more diverse environments.

These are only a few of the stakeholders with whom we engage as we build strong programs in TPC.

TPC practitioners and scholars collaborate across phone lines, internet, hallways, campuses, specializations, and even oceans. But engagement with stakeholders radically changed in 2020–2022 during the COVID-19 pandemic; employers and practitioners moved to remote work, students moved to hybrid and remote learning, and instructors scrambled to shift from in-person to synchronous (and sometimes asynchronous) instruction. The processes of learning and working were complicated in ways that we are still identifying, as we "socially distanced" or used technology in innovative ways to carry on

our work and study. COVID is still ever-present, but practice now depends more on the new norms we established for communication, collaboration, and engagement.

After experiencing almost 2 years of the pandemic, we conceived and proposed this special issue in response to changes we perceived at our universities in our stakeholder engagement practices, and a call went out. Though the special issue's focus is not entirely tied to pandemic responses, we see diversity, innovation, and creativity in stakeholder engagement across the US. We appreciated the chance to read about how administrators and instructors are shifting their collaborative practices, not only because of the pandemic but also because of preventative measures, technology familiarity, increased globalization, and new needs and norms that a worldwide virus created. From those proposals, we selected five manuscripts focused on new models for stakeholder engagement and collaboration.

Articles in this Issue

In "Empowering Stakeholders in a Cohort of Interdisciplinary Writing Minors: Flexibility, Agency, Reciprocity, and Accountability," Melissa Carrion and Ed Nagelhout showcase their program at the University of Nevada, Las Vegas, where they recently established three new interdisciplinary minors: professional writing, science writing, and technical writing. In conceiving and developing these minors, Carrion and Nagelhout were inspired by TPC scholars to build four values (noted in their title) into the design of their program with the long-term goal of engaging stakeholders and building sustainable partnerships. Three minors were proposed to engage STEM majors, with administrative control in the provost's office and leadership rotating through the collaborating departments. Each minor requires 12 semester credit hours (SCHs) focused on writing and design (English Department) and 6 SCHs from other collaborating departments, focusing on writing-intensive courses in other departments to allow students to emphasize coursework in their discipline. Borrowing from stakeholder theory, Carrion and Nagelhout address a model that emphasizes knowing and creating value for stakeholders: "we felt compelled to account for the needs of *all* stakeholders, so that all are treated equally, given a voice, and provided a legitimate outlet for engaging." In their article, they share heuristics and program objectives so other TPC programs can consider this user-centered program model.

In "From Anecdote to Evidence: One Program's Efforts to Define STEM Collaborators' Perceptions of Successful Writing," Ian Weaver and Colleen Reilly showcase their program at the University of North Carolina, Wilmington, where they recently began a participatory assessment

of their science-writing program by reviewing course-specific and related documents and by hosting a focus group session with those who teach the Environmental Science (EVS) capstone course.. Noting that, for 12 years, their enrollment has included a large number of EVS students, and 7 years ago collaborating with the EVS program to prioritize EVS students in the course, Weaver and Reilly determined to learn if their course construct met their STEM colleagues' expectations and student needs. What they learned is that their program exceeds expectations, requiring an expansion of course student learning outcomes (SLOs) and enabling them to ensure that the science-writing course continues to prepare students for more mature writing in their capstone course. Their STEM colleagues provided suggestions but also reported that students thought more critically and wrote more skillfully after taking the science-writing course. Their model includes collaborative discourse with faculty across programs.

In their case study research article "Sustainable Collaboration: A Program Integrating Computer Science and Technical Communication," authors Rebecca Burnett, Andy Frazee, Amanda Girard, Liz Hutter, Halcyon Lawrence, and Olga Menagarishvili share programmatic research, a 10-year case study, from Georgia Institute of Technology to provide computer-science (CS) undergraduate students with technical-communication (TC) training. Building a team/community/network model, the faculty responded to CS graduates' call for more TC instruction for graduates, creating a program (with leadership) that demonstrates decentralized collaboration. The collaborative model includes co-grading, conversation about program development, curricular interdisciplinarity, collaborative assignments, and industry models for performance. The program director serves as the central touchpoint and also oversees faculty onboarding and a community- and industry-involved Expo. The Expo allows students to experience an event like a tech show; involves the community, faculty, and students in experiencing students' work; and markets the program to the greater community. The authors' narrative also addresses funding, legal concerns, and a longitudinal concerns of how the program has developed, considering sustainability and encouraging ongoing discussion about the future of the program.

In his case study research article "Growing Engagement Capacity at a Rural University in a Time of COVID," Patrick Danner shares the challenges of building a new program during the COVID pandemic and in a small, rural school (Misericordia University). His experience focuses on the challenges of finding collaborators; in response to complications related to social distancing, remote work, and complicated

communication processes, he engaged with programs across his university and recruited clients for his "Professional Editing" students. In this way, he demonstrates an interdisciplinary, service-learning stakeholder model based on "magical thinking" (a concept created by Joan Didion and adapted by James Dubinsky) for which his students provided valuable services to research and administrative parties across their university and enabled students to work with clients in a challenging time and in a small, rural community. Danner provides a reflective tone while including commentary from students and university clients, demonstrating the importance of university-wide relationships and service learning for students, and addressing the challenges that smaller universities may face in similar future situations to provide students with active and real-life work experiences.

In their case study research article "Connectivity, Expectations, and Expertise: Co-creation as a Model for Program Development," Katie Walkup, Shahabedin (Shahab) Sagheb, and Robert Smith share details about their program at Virginia Tech University, their external stakeholders, and the co-creation models they have used to develop and assess their program and curriculum. Their program has built an extensive network of industry-academic partnerships (growing from 3 to 75 industry partnerships in 3 years), leaning heavily on a co-creation model in which industry voices and project-based learning influence student learning and program development. Walkup et al. share their process of assessment: through six data-collection points each year, including focus groups, faculty/student discussion groups, and student questionnaires. "We examine transdisciplinary education and socio-technical innovation facilitated by the co-creation model by analyzing how students have adjusted to the educational experience offered by the program, parsing student internship data, and collecting student deliverables related to project development milestones." Through narrative about their program and data to support their growth and observations, the authors provide valuable insight into the continuing growth of a thriving program.

Continuing the Discussion

This special issue provides five models for program development, assessment, revision, and sustainability; however, other models are working in TPC programs around the globe. This issue then begins the conversation and challenges other program administrators and faculty to reflect on their programs, consider their own practices, and evaluate what other collaborative models are working. In this way, we can expand the narrative to also consider how stakeholders—e.g.,

students, faculty, administrators, industry experts, potential employers—are valuable resources in the processes of assessment, development, integration, and network building (among others). The narrative also needs to include how stakeholder engagement can improve TPC programs and instruction as related to cross- and intercultural communication, globalization, diversity, technology development and research, program expansion, and recruitment and retention.

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Sustainable Collaboration: A Co-taught, Client-based Course Sequence Integrating Computer Science and Technical Communication

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Abstract. This case study characterizes a client-based, capstone program integrating computer science (CS) and technical communication (TC). The interdisciplinary CS-TC program began with 50 students and 2 faculty; the current program involves 500–600 students, 8–9 collaborative faculty (half CS and half TC), and a full-time coordinator, and culminates in an end-of-semester public expo for the display and demonstration of student teams' client-based projects. A summary of the three periods of programmatic development is based on observations and a review of documents related to administration, students, faculty, and clients. The case focuses on issues related to stakeholders, collaboration, interdisciplinarity, and sustainability.

Keywords: Linked Courses, Integrated Courses, Client-based Projects, Computer Science, Technical Communication, Stakeholders, Collaboration, Interdisciplinarity, Sustainability

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More than a decade ago, the Division of Computing Instruction (DCI) and the Writing and Communication Program (WCP) at Georgia Institute of Technology (Georgia Tech) tackled a problem: Alums in the College of Computing, one of the university's fastest-growing colleges, expressed the strong opinion that a single, required service course in Technical Communication (TC) was not sufficient to prepare students for the intense communication that would be expected of them in the workplace. The alums wanted Computer Science (CS) students to have more experience with written, oral, and visual communication, and they wanted that TC education better integrated into the work of computer science.

In response to alum concerns, DCI proposed collaborating with WCP to re-envision teaching TC for CS students. Our collaborative, cross-college curricular innovation dismantled two stand-alone, three-credit courses and created four new courses, team-taught over two semesters to link CS and TC. The goal was to give students more experience in TC as well as experience directly and immediately relevant to their major.

This now well-established program provides a fertile space for a case study that examines factors influencing programmatic success and sustainability. Through this case study, we demonstrate that integration of TC and disciplinary instruction is marked by complex relationships with numerous stakeholders; collaboration among students, instructors, administrators, clients, and others; an interdisciplinarity that connects TC and disciplinary instruction; and a sustainability that is integrated into a virtually seamless whole.

This article is about how the whole has been created, explaining our methodology and then documenting the initiation and evolution from a linked to an integrated, interdisciplinary program. We use our program's history to explore four factors: stakeholder commitment, collaboration, curricular interdisciplinarity, and sustainability.

Case Methodology

We offer a case study of a 10-year program, from its inception through to its current success. Case studies are useful because, as Kay de Vries (2020) explained, they permit "description, exploration, and understanding of phenomena" in context (p. 42). Case studies not only synthesize information across time and space, but they also typically include rich description and analysis that might be constrained in other kinds of reporting (Alpi & Evans, 2019; Flyvbjerg, 2006, 2011).

Our case study brings together voices involved in innovation and

decision-making throughout the program's development. As stakeholders and authors of this article, we represent many of the attitudes and actions as they occurred, not just our recollections of programmatic development. Our case study reflects a consistent subject and object (Thomas, 2011), developed from our collection and analysis of data and our reflection about the program. The subject of this case study is a co-taught, interdisciplinary, multimodal program. As stakeholders, we have extensive knowledge about the program that might be useful for other institutions. The object is our analytical framework—a complex network of actors involving people as well as concepts, organizational units, and actions, all characterized by changes over time (Aka & Labelle, 2021; Latour, 1996, 2005).

Case studies sometimes raise methodological concerns (Lindgreen, Di Benedetto, & Beverland, 2021), specifically about validity (accuracy) and reliability (consistency). We have addressed these concerns by, for example, documenting program development in a timeline (CS-TC Program Timeline, 2022), using multiple data sources, using quantitative and qualitative data, basing descriptions and examples on verifiable records, and triangulating data. We believe that a carefully conducted case study can offer insightful, multi-faceted understanding of a complex situation.

We recognize that no program can be lifted from one institution and adopted directly by another. We intend readers to adapt our experiences to their own situations. Colleagues creating their own integrated program not only need to consider a range of factors (e.g., type and size of their institution, their institutional culture, organizational and disciplinary structure, curricular flexibility, faculty willingness to engage in planning, support staff cooperation, and institutional legal support; Burnett et al., 2019) but also reference national discussions about creating programs with partners outside the academy (Bridgeford & St.Amant, 2017; Lancaster & Yeats, 2016).

We have selected representative examples, cross-checking each other to use consistent terms and to create a comprehensive description of this program's development from a range of artifacts:

- observations of administrators, program coordinators, and faculty
- documents to describe the program and its development, including, for example, administrative documents (e.g., course proposals, meeting agendas and minutes, and policy documents); student documents (e.g., syllabi, living schedule, and website); curricular documents (e.g., assignment sheets and rubrics); faculty documents (e.g., onboarding materials, course schedules, and correspondence); and client documents (e.g., a memo of client

expectations, project proposals, and project descriptions)
- official agreements, including memos of understanding (MOUs), intellectual property (IP) agreements, and nondisclosure agreements (NDAs)
- scholarly presentations and publications related to the program

This case study puts 10 years of programmatic history in perspective and offers observations that could be adapted by other institutions considering an integrated, interdisciplinary program. As with all case studies, this one is not all-inclusive. Instead, it depends on available documents, on observations and recollections of stakeholders, and, in this project, on our self- and peer interviews, triangulated because we have had three or more stakeholders recalling events at each of the three periods of the program.

Program Evolution

Our perspective about the evolution of an integrated CS-TC program is situated within communication in the professions (CIP), an approach with one foot in the classroom and one foot in the workplace. We discuss the impetus for the program and its three stages of development.[1]

Our focus on communication in the professions comes from our belief that students learn to be better communicators when they have an actual context, a defined audience, an explicit purpose, and multimodal options (e.g., Bourelle, 2015). For us, such communication includes written, oral, visual, collaborative, and nonverbal interactions, whether face-to-face, print, or digital, whether local or international. Our position is supported by colleagues who note the appeal of hiring STEM students who are effective communicators: "As workplaces become more interdisciplinary, team-based, and cross-cultural, communication competencies valued by industry and expected in entry-level employees [continue] to grow… [including] individuals who can comfortably interact with clients" (Hora et al., 2019, pp. 2222–2223). Various CIP actions demonstrate the CS-TC program:

[1] Prior to 2013, students across a number of disciplines at our institution were required to take a 300-level technical communication service course. Though students in these courses were sometimes assigned projects related to their major as a way to establish relevance, most of our technical communication service courses were not linked to a specific program in the university's other colleges. Only two programs (in business and in construction engineering) had permanent sections officially devoted specifically to their majors, with assignments focused on their majors' professional expectations. Periodically, units would request discipline-specific sections (including aerospace engineering, industrial design, industrial systems engineering, pre-health, and ROTC), but these were not fully developed and ongoing programs.

- Challenge misconceptions about the instrumental nature of professional communication.
- Address complex considerations including cognitive and psychological capabilities of audiences, ethics, and global boundaries with practical considerations such as technology, budget, and schedule.
- Demonstrate that clear objectives are helpful in creating and assessing activities and assignments (Cross & Wills, 2001).
- Present assignments that are "socially and culturally situated, necessarily rhetorical, and subject to critique" (Jones, Moore, & Walton, 2016).
- Reflect rapidly changing workplace practices, affecting the ability of professionals to transfer and adapt "practice knowledge" (Schreiber, Carrion, & Lauer, 2018, p. 2).

The resulting CS-TC program has had three phases of development: (1) the Early Years involved planning, piloting, and implementing linked courses; (2) the Middle Years involved fully integrating the curriculum and implementing a public-facing expo; and (3) the Established Years started with hiring a full-time coordinator to stabilize and sustain the integration. (See the CS-TC website for a table with details of the program's phases; CS-TC Program Timeline, 2022).

The Early Years

The initial planning committee included the Director of DCI, the instructor of the CS capstone course, and the WCP Director. This committee started exploring possibilities in spring 2012. In fall 2012, the WCP Associate Director and a new TC instructor joined the committee. An agenda from August 2012 shows that the goal was simple. CS requested discipline-specific sections of the existing TC service course (with some co-teaching as well as shared readings, assignments, and assessment). This goal rapidly evolved into a plan that made clear the committee was talking about developing new courses, not just offering variations of existing courses. These five colleagues met weekly during the 2012–13 academic year to design a new program (CS-TC Planning Committee and Program Coordinators, 2022).

The committee strategized ways to combine CS and TC. During part of the planning year (spring 2013), the CS instructor and the TC instructor piloted two joint CS-TC assignments (final project team presentation and post-project review) in one section of a standalone TC service course. The instructors co-created the assignments, the TC instructor introduced the assignments in class with the CS instructor present, and both assessed the resulting work. The goal was to create

models and a process for shared assignments and assessment criteria. At the same time, the administrators worked to create programmatic policies and procedures:

- Sought approval for the four new courses by school, college, and university curriculum committees.
- Consulted with the registrar to schedule a common cohort of students and created a process to register students as teams for the second semester of the course.
- Considered criteria for hiring and pairing instructors.
- Negotiated TC faculty workload (moving from a 3:3 load with 60–75 individual students to a 2:2 load with 100 students on 20 teams).
- Agreed on policies such as attendance and participation.
- Informed upper-level administration and support personnel about the new program.
- Managed the program, including WCP's request for the College of Computing to fund a full-time coordinator.

Initially, WCP proposed seamlessly integrated courses in which all assignments fulfilled both CS and TC objectives and all tasks contributed to learning in both disciplines. However, CS saw complete integration as radical and risky. So we compromised: all major assignments were jointly CS-TC, but some smaller assignments were CS-only (introduced and evaluated by the CS instructor), and some were TC-only (introduced and evaluated by the TC instructor). Major joint assignments included project proposals, project specifications, feasibility reports, progress reports, and oral presentations. All joint assignments were evaluated by both instructors. Thus, the course sequence at the beginning of the program was one-third CS, one-third TC, and one-third integrated. This linked approach took several years to evolve to a fully integrated approach, as the benefits of such integration became clear.

To reflect the linked structure, some days became "CS-TC teaching days" (both instructors responsible for in-class activities), some days became "CS teaching days" (the CS instructor responsible for in-class activities), and some days became "TC teaching days" (the TC instructor responsible for in-class activities). The schedule was color coded to reflect the three types of teaching and assignments. However, both instructors were present in class on all teaching days.

During these Early Years, we implemented strategies that emphasized CS-TC balance:

- Both CS and TC parts of the linked courses were introduced in the

first class session.

- Linking the courses required a shared physical classroom. Both instructors regularly discussed ways to share in-class time guided by schedule, topics, and assignments.
- Because the linked courses had to satisfy two sets of requirements, using separate syllabi was seen as necessary.
- Students' main source of information about the course was a living schedule created in Google Docs—easily and regularly updated. The living schedule presented day-to-day activities, including dates, course topics, readings, and links to assignment descriptions and other materials.
- Each course had its own LMS for submitting assignments, providing feedback, and assigning grades. An online platform (Piazza) was used for discussions and peer review of assignment drafts.
- To make connections for students during class, TC instructors often used CS-based examples to illustrate TC concepts.
- To reinforce CS-TC links, instructors used the same grading rubric to give students feedback on assignments.

Initially, all students were in face-to-face sections, but the instructors experimented with online and hybrid teaching. Two hybrid sections and one online section taught in years 4 and 5 were the focus of an IRB-approved mixed-methods study to compare face-to-face and hybrid sections (Burnett, Menagarishvili, & Frazee, 2019; Kmiec, Menagarishvili, & Longo, 2017a, 2017b; Menagarishvili, 2018; Menagarishvili, Frazee, & Burnett, 2022a, 2022b).

As the number of sections grew, we standardized onboarding of new instructors. In year 5, we began regular meetings for all continuing and new instructors (weekly meetings during the first month of the academic year; monthly meetings after that). A Google Drive folder with a template living schedule, sample assignment sheets, and sample agendas for every class meeting was used to discuss the courses. Discussions during these meetings facilitated interactions among all CS-TC teaching pairs. Finally, a CS-TC Course Context document was created to describe the goals, history, and content of the courses as well as recommended pedagogical approaches.

The Middle Years

Until 2015–16, the demarcations between CS and TC course content and instructor responsibilities limited both the ability of instructors to fully collaborate and students' understanding of the courses' integrated purpose. These demarcations communicated mixed messages,

reinforcing students' assumptions about TC and CS work and the value of that work.

By year 5, the CS instructors came to recognize the enormous benefits from full integration, something they saw as risky 5 years earlier. Full integration resulted in a number of pedagogical and administrative changes. Though this change was strongly supported by the CS instructors, the TC postdoctoral fellows coordinating the program largely designed and implemented the curricular changes such as these:

- Course learning objectives were revised to reflect fully integrated expectations, leading to a new single syllabus.
- CS- and TC-only designations were eliminated, all assignments were now shared, and all class sessions were integrated.
- Existing assignments and assessment criteria were revised, and new assignments were introduced to reflect evolving industry standards. For example, a formal usability module was developed.
- Instructors negotiated more effective ways to share class time, teaching responsibilities, and assessment.

Because the institution's LMS had evolved, we could merge the separate CS and TC course sites into one, presenting students with a unified place for communication. Additionally, we established shared course policies about attendance, client feedback, team charters, and peer evaluations. As the program grew, WCP continued to request that the College of Computing fund a full-time coordinator.

In year 6, TC instructors proposed a public-facing expo to replace the second-semester software demos that teams previously presented to peers, faculty, and clients. In spring 2018, working with the College of Computing's Assistant Dean for Outreach, Enrollment and Community, the postdoctoral fellow coordinating the program created the first full-day Computer Science Junior Design Capstone Expo (thereafter referred to as the Expo). This Expo was intentionally different from existing capstone expos on campus so that it more closely reflected software industry events. Teams staffed their booths, demonstrating their project and answering questions from attendees. (For further details about the Expo, see KellyAnn Fitzpatrick, 2019. Fitzpatrick was a former program coordinator who interviewed another program coordinator and an event manager about the details of this now semi-annual event.)

Once the Expo had a visible presence on campus and with the workplace community, the College of Computing finally agreed that a permanent program coordinator be hired. A job description was

agreed on by WCP and DCI; these units also drafted, revised, and their colleges signed an MOU designating responsibilities of each in relation to the new position. The person hired for the position was a TC instructor who knew the program well.

The Established Years

The current version of the program reflects more than a decade of development, leading to a well-established steady state: 500–600 students, typically 9-12 CS-TC faculty, and 100+ clients. Maintaining close relationships with CS faculty has led to regular updating of curriculum to match industry standards.[2] With each new instructor or new instructor pair, new insights are brought into the program.

The program's newly established, permanent, full-time coordinator (with a PhD in rhetoric, theory, and culture), funded by the College of Computing, balances pedagogical and administrative responsibilities. Pedagogically, the coordinator develops curriculum, applies disciplinary and workplace standards to courses, orients new instructors, and co-teaches several sections of the courses. The coordinator is employed by DCI but maintains close connections with WCP, being responsible, for example, for onboarding and professional development of new TC hires. Administratively, the coordinator assists with scheduling, organizes and facilitates stakeholder meetings, updates legal requirements, and plans and implements the Expo. Additionally, the coordinator recruits and vets clients and organizes the registration permit process. The coordinator takes a proactive approach to attracting clients and drawing attention to the CS-TC program by creating a website where projects are submitted. She also works with the university's legal office to streamline non-disclosure agreements for clients, students, and instructors. Further, she has sought other resources on campus to aid students with their IP rights. Finally, the coordinator maintains an MS Teams site as a virtual space for instructors and student teams in the course series.

This much-abbreviated narrative of the CS-TC program's development provides the foundation for our analysis of factors that webelieve provide insight about the success of the program: stakeholders,

[2] We recognize accreditation and assessment as important for programmatic creation, evaluation, and evolution. The Georgia Tech College of Computing (COC) has decided to not assess the CS-TC courses for accreditation purposes because CS undergraduate students are not required to take these specific courses to satisfy junior design degree requirements. Other course options to complete the degree include Create-X, VIP, and a research project. The COC assessment focuses on the CS3001 course, "Computing, Society, and Professionalism," a requirement that all CS majors must take and a prerequisite to the CS-TC Junior Design Capstone course series.

collaboration, interdisciplinarity, and sustainability. We situate each of these briefly in the literature before providing details that we hope effectively document this case study as well as provide direction for other institutions.

Stakeholder Commitment

Stakeholders (human actors) are involved in a complex programmatic network, including physical and digital work/display spaces, curriculum, instructional technology, institutional policies, and legal compliance. In this case study, we analyze the roles of and committed relationships among stakeholders and institutional actors. However, because of space constraints, not all roles and responsibilities of individual stakeholders and institutional actors are included in our discussion; rather, we represent major decisions, responsibilities, and historical underpinnings. As the program has evolved, stakeholders have shifted—not the categories but the people in the categories and the relative roles and influences of the categories. For example, when the coordinator became a permanent position, the day-to-day roles of the DCI and WCP directors diminished. As the number of clients increased and projects became more complex, the role of the Office of Legal Affairs increased from occasional contact to a regular supporting role.

All stakeholders have a definable commitment to the program, participate in some way, and bring value (which is to say they influence and have articulated responsibilities; Pirozzi, 2019). Although all stakeholders are important in this program in that they "are both recipients and (co)creators of value" (Freudenreich, Lüdeke-Freund, & Schaltegger, 2020), they nonetheless do not have the same level of understanding of, involvement in, or commitment to the program. They sometimes have roles that barely or indirectly interact; their roles or goals may even appear contradictory because each stakeholder has "a different understanding of what constitutes value" (Freudenreich, Lüdeke-Freund, & Schaltegger, 2020)—even though they all want the program to succeed. Here we characterize the individual stakeholders and institutional actors.

Individual Stakeholders

Stakeholders influence and are influenced by the other actors, directly or indirectly. In this case study, stakeholders include faculty, students, clients, and the program coordinator.

Faculty. Faculty assume a number of roles with other stakeholders in the network (e.g., helping students understand workplace expectations). Additionally, faculty coordinate with their teaching partner- about assignments, classroom activities, assessment, and

project/course evaluation. Finally, in the early phases of the program, faculty had a relationship with clients through their outreach to and recruitment of new clients; however, since 2019, this role has been assumed by the coordinator.

Given the central role the faculty play as stakeholders, program administrators have focused particular attention on hiring criteria. Since the beginning of the CS-TC program, the courses have been taught by faculty with advanced degrees and workplace experience. The computer science instructors who have taught in the CS-TC program have been PhD lecturers, PhD graduate students, or academic professionals, some with industry or military experience. CS determined that faculty with a PhD, near completion of a PhD, or with significant work experience were qualified to teach in the program. Similarly, the TC instructors who have taught in the CS-TC program have been postdoctoral fellows in WCP, nearly half with PhDs in rhetoric/TC/composition and the others with PhDs in other areas of English studies, with the additional requirement of industry experience. (See the CS-TC website for tables summarizing the program's faculty, including the numbers each year of the program and the advanced degree of each faculty member: CS-TC Instructors by Year, 2022; CS-TC Faculty Education, 2022).

During the process of approving the new courses, experienced tenure-track TC faculty insisted that the CS-TC instructors have a PhD in TC to establish TC expertise within the interdisciplinary collaboration. Over time, requiring a PhD specifically in TC softened, though the instructors appointed to teach these courses continue to be selected according to specific rigorous criteria.

Once faculty were hired, administrators attended to faculty professional development. Prior to teaching the course, all faculty participate in a week-long orientation, including sessions with the CS-TC coordinator. During these sessions, new instructors learn about the curriculum, meet their teaching partner, and begin collaborating with them. All TC instructors participate in the Technical Communication Postdoctoral Seminar during their first semester. All CS-TC instructors take part in further orientation and mentoring through the auspices of the CS-TC coordinator.

At the heart of instructor onboarding, orientation, and professional development—and of transmitting course knowledge from one generation of CS-TC instructors to the next—is the extensive set of resources overseen by the CS-TC coordinator (resources currently on an MS Teams site where stakeholders can also participate in chats and

virtual meetings). These resources include details about curriculum, syllabus templates, assignment sheets, assessment criteria and rubrics, class presentations, and other materials that provide a structured framework for new instructors.

Students. The CS-TC students can be accurately described as learners with entrepreneurial spirits. The student teams are expected to address "problems with innovative solutions—solutions that could involve new combinations of products, services, processes, or principles" (Spinuzzi, 2017). Though the core problems have already been defined by the clients, the student teams refine the problems, conceptualize them, and develop software solutions to resolve them. Some students have already gained industry experience through co-ops and internships. Many are just beginning to develop an entrepreneurial mindset and to understand the resourcefulness necessary to learn the ever-changing platforms and coding languages of their discipline.

Because each student team is working with a client, the team works together in a consultancy role. The CS-TC program helps students navigate the change from acting as students (in which problems have right and wrong answers, a clearly defined timeline, and an expectation of coding languages to be used based on what they are learning) to acting as workplace professionals. Moreover, the interdisciplinary collaboration empowers CS students to think of their work beyond its creation and in situ with TC (Johnson-Eilola, 2004). CS students soon realize that they cannot just give clients what they ask for because clients seldom have the same level of technical knowledge. Instead, teams explore new ways of creating and communicating. They find that every choice requires a conversation with teammates and their client. The course sequence provides students opportunities to fail as well as succeed. The students sometimes fail at teamwork, at satisfying course expectations, and, even, at meeting client expectations. However, when this happens in their student role, they do not lose their livelihood, and they learn new ways to navigate CS industry experience before entering the workplace.

Clients. Prior to developing the CS-TC course sequence, the standalone CS capstone course used actual clients—stakeholders with software development needs the student teams could address. The CS-TC program reflected DCI's disciplinary preference for client-based, project-based curriculum. Fortunately, the client base has continued to grow because many previous clients propose additional projects or recommend the program to others. In the network, clients act as stakeholders who are looking for a complete project solution. Clients act as stakeholders not only based on the outcome of the project but also in

their contribution to the students' role as learners. As mentors, clients shape the students' understanding of time commitments, communication, and feedback in a professional environment.

The client must agree to provide guidance to the student team(s) throughout the two-semester project. Though students are responsible for maintaining contact, each client is expected to respond to student correspondence in a reasonable time. The client must also agree to provide feedback about the performance of the team(s) to instructors. As initiators of the project, clients are also expected to communicate regularly with students about the scope and the development of the project, as well as discuss resources through a flexible partnership with students (Hea & Shah, 2016). At the end of the project, clients may continue to work with student teams, but no guarantee exists for further support for the software solution.

CS-TC Program Coordinator. From its beginning, the CS-TC program has required regular collaboration and coordination among the actors (Duin, Tham, & Pedersen, 2021). The CS-TC program has had three evolving phases related to the coordinator role.

During the pilot year (during the Early Years), CS and TC administrators worked with the two instructors to plan and organize what was needed. When the CS capstone was a stand-alone course, interaction with project clients was managed by the CS instructor; that practice continued when the CS-TC courses were linked.

Once the pilot year was completed, a TC postdoctoral fellow was asked to coordinate the program day to day. Responsibilities included a range of pedagogical and administrative tasks: orienting faculty to assignments; facilitating faculty inter- action; synthesizing syllabi, assignments, and assessment; updating assignments; reviewing and recommending policy changes; planning the Expo when it was created; and troubleshooting immediate problems. The CS instructor continued to manage interaction with project clients and to organize a registration permit process for students.

At the beginning of the Established Years, the College of Computing, in consultation with WCP, created and funded a position for an academic professional to coordinate/manage the program. The new coordinator assumed responsibility for the tasks described above as well as managing clients and registration permits for students. The coordinator also took on the role of working with the institution's attorneys on the NDA process and other entities on campus to ensurestudents could review IP agreements. The coordinator is employed by

DCI while maintaining close connections with WCP.

Institutional Actors

Although the core of the CS-TC program is comprised of individual stakeholders (e.g., faculty, students, clients, and the coordinator), institutional actors are essential for the program's development and success, including a group of supporting stakeholders as well as the larger institutional offices and institutional vision.[3] Table 1 displays many of these stakeholders and identifies some of their responsibilities. Informing them about programmatic changes, challenges (especially expectations for their time and budget), benefits (e.g., to student learning, to the use of faculty expertise, to programmatic/institutional reputation), and immediate and long-term implications helps these stakeholders. Though these stakeholders are integral to the success of the program, their effectiveness in supporting the program depends upon timely and relevant information.

Table 1. Institutional Actors

Stakeholder Group	Supporting Stakeholders	Selected Responsibilities
Student Classroom Support	• Academic advisors • IT professionals	• Academic advisors guide students about programmatic requirements and advantages of one curricular option over another. • IT professionals advise about, order, install, and maintain classroom and team technologies.

[3] Accreditation is an expected future institutional actor in our interdisciplinary program. The Association for Interdisciplinary Studies (AIS) recognizes the need for the assessment of programs, but also notes that interdisciplinary accreditation is not yet an established practice (see https://interdisciplinarystudies.org/assessing-ids-programs/). Our program follows many of the AIS recommendations, such as program goals, an established curriculum, administrative support, and so on, and continues to work towards targeted assessment. Georgia Tech's accrediting body, the Southern Association of Colleges and Schools Commission on Colleges (https://sacscoc.org/accrediting-standards/), has not addressed the need for interdisciplinary accreditation formally; however, we continue to consult with assessment coordinators and other stakeholders within both the Writing and Communication Program and the College of Computing about ways to best evaluate the CS-TC program.

Table 1. Institutional Actors (cont.)

Department/ School	• School curriculum committee • Program directors/ associate directors • Course schedulers • School chair	• Department/school curriculum committees approve new courses. • Program directors/associate directors encourage innovation and troubleshoot problems. • Course schedulers can make or break a course and identify pitfalls. • School chairs need to anticipate potential problems, manage political challenges, and know likely benefits.
College	• College curriculum committee • Deans/ associate deans	• College curriculum committees approve new courses. • Deans/associate deans need to anticipate problems, manage political challenges, and know likely benefits.
Institution/University	• Institution curriculum-committee • Registrar • Provost	• The institution curriculum committee approves new courses. • The registrar needs to enter new courses as well as manage graduation requirements and scheduling. • The provost needs to know likely benefits.
Workplace	• Client liasons to student teams	• Client liaisons can simplify or deter access, depending on perceptions of the importance/ relevance of regular interaction.

As our program has grown and matured, the network of stakeholders has been dynamic, responsive, and flexible—to meet the needs of the program. Some stakeholders have been consistent, such as the Office of Information Technology, which regularly helps meet program needs. Some stakeholder's roles expanded; for example, we described above the increasing role of the Office of Legal Affairs to meet the legal requirements of students and clients. Some stakeholder roles have been entirely redefined, as with the formalization of the CS-TC coordinator to manage logistical tasks, supervise and maintain curriculum, facilitate onboarding and professional development, and facilitate stakeholder relationships.

Collaboration

One of the critical factors contributing to the success and longevity of the CS-TC program is collaboration—teaching partners, student teams, client relationships, and a range of other interactions that make the program function. In CS-TC courses and in the program as a whole,

> … collaboration involves substantive interactions between and among people who share goals and exchange information as they work toward those goals in a variety of settings and with a variety of tools, either because the task size or complexity is too great for a single person or because the task will benefit from multiple perspectives. (Burnett, Cooper, & Welhausen, 2013)

Not only is collaboration good educational practice, but it has long been prevalent in the workplace (Cohen & Bailey, 1997), with the distribution and diversification of teams increasing the frequency of "direct collaboration among individuals who do not share the same kinds of expertise" (Schreiber, Carrion, & Lauer, 2018, p. 2).

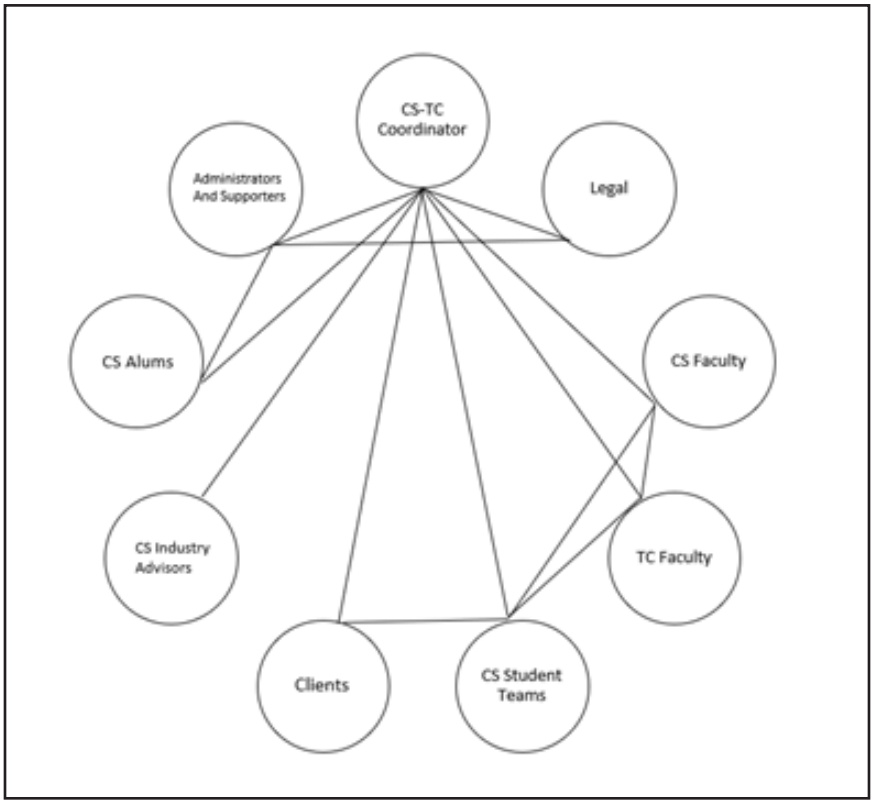
Although the practice and value of collaboration among our students and working professionals have always been a priority in the CS-TC program, we note distinct characteristics of the program's collaborative practices among stakeholders. Collaboration grows in complexity as the number of stakeholders increases and a program matures. In the CS-TC program, this complexity is demonstrated, for example, in relationships that emerged among course coordinator, faculty, students, clients, and the Office of Legal Affairs. To navigate these complexities, we have found the following approaches to collaboration to be central to programmatic success:

- Acknowledge and respect interdisciplinary differences and boundaries that shape ways in which collaborators work, teach, think, make knowledge, and make decisions. (We discuss these differences in the following section on interdisciplinarity.)
- Acknowledge power differentials across disciplines and between individual and institutional actors in the network (e.g., relationships between clients and students and relationships between CS and TC faculty pairs).
- Build trust and cultivate interactions that foster psychological safety.

Collaboration in the CS-TC program is decentralized and distributed, so no one actor in the network drives the collaborative efforts. For

example, though Figure 1 shows that the CS-TC coordinator is central to the network, the coordinator does not mediate all collaborative relationships in the program.

Figure 1. Distributed collaborative partnerships among some institutional and individual actors in the CS-TC program.



Stakeholder responsiveness is another distinguishing characteristic of the program's collaborative relationships. For instance, in the onboarding process, CS-TC assignments are introduced by the CS-TC coordinator, including learning goals associated with each assignment. As the CS-TC teaching pairs work together to shape their classroom and coordinate their collaborative relationship (Robinson, Dusenberry, & Lawrence, 2016), each pair gleans insights and learns new things to share with the other teaching pairs and the coordinator, taking advantage of "collaboration among individuals who do not share the same kinds of expertise" (Schreiber, Carrion, & Lauer, 2018, p. 2). In the CS-TC program, collaboration is central (Duin, Tham, & Pedersen, 2021), training is essential to "facilitate building a personal awareness of interdependence among team members" (Dusenberry & Robinson, 2020, p.

207), the conception of the problem is constructed and shared (Baker, 2015), and learning to identify and manage types of conflict improves interaction (Burnett, 1993, 1994).

Building and maintaining good will between and among the network's actors helps develop collaborative partnerships. These characteristics of collaboration in the CS-TC program enable the actors to effectively engage with and respond to issues of interdisciplinarity across the program's dynamic and changing contexts (e.g., Hutter et al., 2018; Paretti, 2008; Ritter, 2012).

Program Collaboration

The CS-TC program's full-time coordinator serves as the point of contact for anyone interested in or involved with the program, assuming responsibility for four primary areas of collaboration:

- *College- and university-level conversations* highlight the program and help to establish connections with other capstones. College- and university-level conversations raise awareness about the CS-TC program and make publicity or referrals consistent. The Expo brings attention to the program and promotes recognition from college leadership.
- *Onboarding, orientation, and professional development* are scheduled for everyone new to the program or returning from a hiatus. Additionally, the coordinator typically co-instructs with new DCI faculty.
- *Instructional faculty* in the CS-TC program meet multiple times per semester to connect with each other. The coordinator addresses problems and requests input for curriculum revision. Meetings may also include other stakeholders to explain or demonstrate new procedures or opportunities.
- *New client projects* are arranged by the coordinator, who uses referrals and established relationships built by her predecessors. Clients may meet with the coordinator or just submit a project proposal. However, clients need to understand that their project may not be chosen and that they will be working directly with a student team.

The continuity of the CS-TC program relies not only on current collaboration but also on the connections and collaborations that were able to continue as the program has developed.

Faculty Collaboration

From the beginning, CS and TC faculty negotiated differences in understanding what effective pedagogy entailed. CS faculty were accustomed to lecturing and then expecting the student teams to work independently. In contrast, TC faculty were used to employing active learning that focused on small group problem solving and supported

"the process of having students engage in some activity that forces them to reflect upon ideas and how they are using those ideas" (Prince, 2004, p. 160). Active learning was agreed on for all CS-TC classes, and both instructors introduce active learning to students at the beginning of the course. As the courses develop, instructors learn from each other and customize a combination of active learning activities, including discussions, mini-lectures, document analysis, peer review, small-group problem solving, and independent teamwork (with oversight and guidance from the instructors). Whether teaching face-to-face, online, or hybrid sections, instructors see students as participants, not passive recipients, so team activities predominate, and lectures are minimized.

As the program moved from being linked to being fully integrated and the number of instructors increased, instructors acknowledged a broader range of pedagogical approaches. For example, by year 5 of the program, all instructors agreed to use an assignment sheet for each assignment (specifying purpose, audience, design, and so on), and both CS and TC instructors for each section were involved in the grading of all assignments. The courses evolved so that all instructors blended widely accepted pedagogical approaches (e.g., explicitly teaching collaborative strategies) and industry practices (e.g., using iterative Scrums).

Student Collaboration

In the CS-TC program, each class is divided into 10 five-person teams, usually constructed by their instructors; thus, for each course project, an instructor receives 10 artifacts (one from each team) rather than 50 (one from each student). At the beginning of the first semester, each team creates its own team agreement, characterizing the collaborative expectations and responsibilities. This agreement is revisited periodically and can be revised. Though teams are self-governing, instructors typically meet with teams individually and establish policies to reduce problems. Teaching collaborative processes and strategies is part of the curriculum.

Students often express concerns about working in teams. In the study that was conducted in year 5, the two most common categories of team-related concerns were (1) process, including composing in teams; recursive processes in teams; and management of time, efficiency, and schedule in teams and (2) community, including "initiating and engaging in conversation; dealing with individual/team balance, roles, collaboration, and the working environment; managing anxiety

or difficulties related to teamwork; and dealing with the stress of interaction" (Burnett, Menagarishvili, & Frazee, 2019, p. 177). Beyond the teamwork, students are engaged in other kinds of collaboration, including active learning, collaborating with faculty, and working with clients.

Interdisciplinarity

Faculty often define interdisciplinarity as integrating disciplines or disciplinary knowledge and, thus, as a "means to increase problem-solving capacity and a working method for reaching a common goal" (Kans & Gustafsson, 2020, p. 5). Faculty exchange ideas and disciplinary knowledge/experience, thereby strengthening their own disciplinary understanding and extending their networks. In fact, interdisciplinary courses have a long history in technical and professional communication, and they can be notably successful if an institution commits systems and resources to such course innovation (e.g., Burnett, Menagarishvili, & Frazee, 2019; Fitzpatrick 2018a, 2018b, 2018c, 2018d, 2018e, 2018f, 2019; Ford & Riley, 2003; Kain & Wardle, 2005; Watts & Burnett, 2012; Williamson & Sweany, 2004). We want to push the definition further by discussing practical negotiations and compromises necessary to create an interdisciplinary course sequence in which the two disciplines see themselves as equal partners.

Efforts to integrate "perspectives/concepts/theories, and/or tools/techniques, and/or information/data from two or more bodies of specialized knowledge or research practice" (Porter et al., 2006, p. 189) increase insight and productivity. Beyond opportunities to develop competence in coding and communication, students in the CS-TC program develop interdisciplinary competence in areas that defy neat categorization: developing proposals, managing projects, interacting with clients, and testing usability. For example, students' "Detailed Design" assignment requires integration of technical and rhetorical knowledge in these ways:

- Communicate an architecture to all interested parties.
- Support the tasks of architecture creation, refinement, and validation.
- Represent hierarchical detail including the creation of substructures by instantiating templates.
- Support the analysis of the architecture.

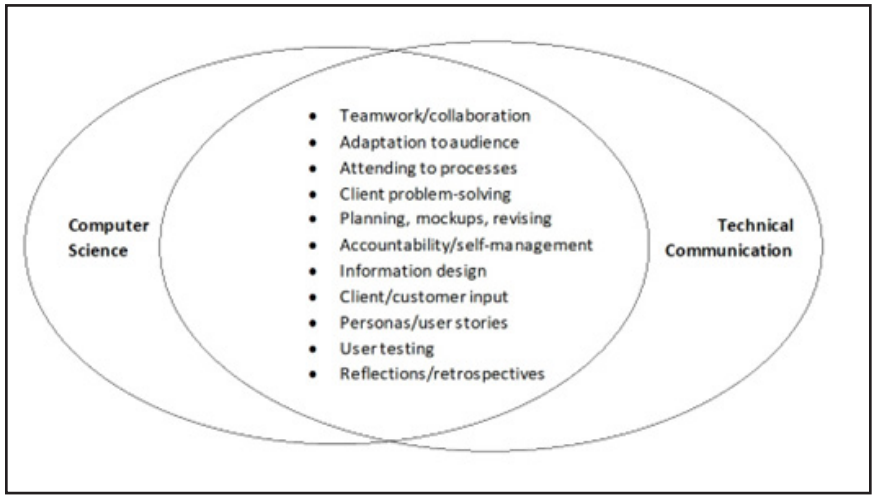
The kind of interdisciplinarity in the Detailed Design assignment is foundational for the CS-TC program; experiences from both CS and TC help students become more observant, insightful, and effective

professionals, more functional in diverse workplace situations, and more responsive in addressing complex problems. Not only do students learn that success as a CS professional depends on more than their ability to code, but faculty learn that they have a co-equal, mutual interdependence with their disciplinary partner in which they jointly address challenges that include negotiating curricular interdisciplinarity and creating an interdisciplinary, public-facing expo (e.g., Burnett, Menagarishvili, & Frazee, 2019; Nardone, Strubberg, & Blackburne, 2020; Fitzpatrick 2018a, 2018b, 2018c, 2018d, 2018e, 2018f, 2019, 2021; Ford & Riley, 2003; Watts & Burnett, 2012).

Curricular Interdisciplinarity

The curriculum integrates theory, research, and practice from both CS and TC, as Figure 2 illustrates. As disciplines collaborate and move toward an integrated approach, their commonalities define some of what is shared. Figure 2 illustrates the kinds of intersections that anyone might make in integrating technical and/or scientific communication with another discipline.

Figure 2. The intersection of CS and TC defines some of what is shared between the disciplines.



One example of interdisciplinarity is using Agile (an approach borrowed from industry) with what are called Scrums to manage complex software and product development. The student teams are responsible for defining/refining the client problem, deciding how to do their work, considering options, and developing a solution. An Agile approach using Scrums is especially suitable to CS-TC because it depends on concepts, processes, and artifacts familiar to both CS and TC faculty:

expectation of regular communication, concern for client/customer input, development of personas and user stories, story mapping, articulated criteria, planning, regular meetings to share information, iterative product and user testing, drafts/mock objects, and reflections/retrospectives (see Figure 2).

The interdisciplinarity of an Agile approach encourages CS and TC faculty to work toward the same broad goals: students who are better written, oral, and visual communicators in their academic and professional lives; who understand communication as a process within intertwining networks; who better understand the social, psychological, political, and ethical aspects of communication; who are better able to communicate their technical ideas; and who are more competent and confident in communicating with classmates, colleagues, and clients. The challenge has been accomplishing these goals. Despite commonalities, we have to work out the mechanics of functional interdisciplinarity: what's an ideal class size, how course credits should be allocated, and how an assignment should be presented, assessed, and evaluated.

Class Size. Everyone on the planning committee agreed that the classes needed to be small in these courses; however, administrators and faculty expressed dramatic disciplinary differences about what constituted "small." For a typical CS class, 50 students per section is considered small; for a TC class, 50 is immense. We compromised: students would work on five-member teams, so although a class section has 50 students in it, those students work collaboratively and submit their work as a team. All assessment focuses on team artifacts, each one reflecting interdisciplinary competencies.

Course Credit. We started with two 1-term, 3-credit courses. We developed an interdisciplinary program that extended over two terms but continued with the same number of credits, equally divided—3 for CS and 3 for TC (see Table 2).

Credit allocation reflects the emphasis of the interdisciplinary deliverables student teams complete in each term. The first term focuses on activities that contribute to the development of a software prototype. The tasks require understanding and practice of TC knowledge such as establishing client relationships, defining a problem, conceptualizing a software solution, and testing a prototype. The second term shifts the emphasis to coding through students' development of the prototype created in the prior term.

Table 2. CS-TC course credits

	ORIGINAL Independent Courses*	REVISED Course Sequence	
Term	**Term 1 OR Term 2**	**Term 1**	**Term 2**
CS	CS 4911 (3 credits)	CS 3311 (1 credit)	CS 3312 (2 credits)
TC	TC* 3403 (3 credits)	TC 3432 (2 credits)	TC 3431 (1 credit)
Credits	Total 6 credits	Total 6 credits	

*Throughout the article, the technical communication courses are labeled as TC to be consistent in the discussion. In the actual institutional catalog, a different signifier identifies the courses.

Assignments. During the Early Years of the CS-TC program, assignments called attention to a disciplinary difference in introducing and explaining assignments to students. CS faculty were accustomed to giving assignments orally and not necessarily identifying assessment criteria, whereas TC faculty regularly used assignment sheets to detail the assignment requirements, explain expectations about the deliverable, provide basic rhetorical information (e.g., purpose, audiences, and expectations about format, organization, and design), and specify assessment criteria. Near the beginning of the program, faculty decided to use assignment sheets for major projects, but their use has developed as the program has matured to include all course assignments.

Currently, all the activities and assignments support the goal of producing a software solution to a client's problem. In working toward this goal, students complete a number of assignments that are unquestionably interdisciplinary, characteristic of both CS and TC: *prototype descriptions*, *design reports*, *recommendation reports*, *final reports*, and various kinds of *presentations*. However, the courses also have other required assignments: a team charter (managing project responsibilities), a *vision statement* (guiding students in conversations with stakeholders), an *MOU* (working as a team-client agreement), *user stories* (characterizing expectations about users), a *demo video* (displaying the operational solution to the problem), and a *retrospective* (a reflective memo capturing the process). All assignments are submitted by the team, with the team receiving the assessment and evaluation.

Assessment and Evaluation. Because of disciplinary assumptions and practices, CS and TC faculty had different notions about assessment of assignments, characterized by what Sally Henschel and Lisa Melonçon (2014) have differentiated as conceptual skills and practical skills. Henschel and Melonçon described research-based conceptual

skills: rhetorical proficiency, abstraction, social proficiency, experimentation, and critical system thinking. Each conceptual skill is supported by a cluster of practical skills. For example, the concept of rhetorical proficiency is supported by practical skills such as user analysis, information design, writing, and editing. This attention to both conceptual and practical skills defines what CS-TC faculty eventually decided mattered in assessment and grading, but that was an evolving agreement.

For example, TC instructors initially expected formative assessment to be built into the process of assignments, while CS instructors simply made themselves available to respond to questions if students raised them. With summative assessment, CS faculty initially expected they would assess CS/coding content and TC faculty would assess the mechanical/grammatical conventions of the writing; in fact, CS faculty were surprised by the concern of TC faculty for conceptual skills rather than simply conventions and correctness. TC faculty were led by their disciplinary assumptions to expect that CS and TC would both respond to all aspects of each team's artifacts. Further, the nature of feedback comments differed; CS faculty were especially concerned with conventions and correctness (e.g., if code worked or not), whereas TC faculty were especially concerned with a broader range of response. For example, although TC faculty were also concerned about issues of conventions and correctness in students' writing, they were also concerned about the rhetorical appropriateness paying attention to audience, purpose, context, tone, etc. More particularly, differences included approaches to assessment (e.g., the amount of feedback expected), reliance on an instructor for grading or dependence on a teaching assistant/grader, and awareness of differences resulting from the number of students in a class. Currently, onboarding and the ongoing professional development workshops include attention to both conceptual skills and practical skills as well as formative and summative assessment.

Public-facing Expo

The Computer Science Junior Design Capstone Expo for the CS-TC program is the site for student teams' final presentations at the end of the term. Each student team produces deliverables, including table staging, handouts, an appropriate elevator pitch, screen displays, and a product demonstration. These deliverables reflect materials common to software industry events rather than to academic events (such as posters; Fitzpatrick, 2019). The Expo balances a display of coding competence and communication competence, showcasing the work

completed during both terms. Specifically, the Expo is designed to accomplish these objectives:

- Help students develop TC skills specific to software industry events such as tech shows, tech conferences, expos, and recruitment fairs.
- Familiarize students with the processes and deliverables associated with such events.
- Provide a public venue where clients, instructors, administrators, and students can experience and celebrate the work done by CS-TC students.
- Increase the visibility of the course sequence and recruit future project clients (Fitzpatrick, 2019).

The Expo for the CS-TC program is an interdisciplinary, community-centered event that attracts positive attention. The Expo for the CS-TC program is scheduled on a separate day than the capstone design expo for engineering programs at the university, so visiting companies, others from across campus, and alums can attend and view students' work from both CS and engineering. Attendance at the Expo for the CS-TC program fosters intra-college communication, client referral and recruitment, outreach for future student employers, and a venue for other CS-TC students to ask questions and familiarize themselves with their peers' work. Moreover, presenting students gain the skills necessary to explain their project to multiple audiences, discuss their qualifications and skills as experts, answer spontaneous questions, and engage in conversations important to their future career goals.

Sustainability: The Ongoing Conversation

For us, sustainability is "the ability of a system to maintain its health and diversity" (Fleckenstein et al., 2008, p. 411). We believe "our classrooms should offer compelling environments" (Sirc, 2002, p. 1) "for new collisions of ideas, interest, [and] creativity [and, thus, maintain] the energy, interest, and growth of students" (Newcomb, 2012, p. 596). A capstone program such as the one we analyze "brings together theories and practices of the academic field and the workplace" (Melonçon & Schreiber, 2018, p. 322). Designing a situated, sustainable program not only requires attention to functionality but also to an imagined future. The process should always be rhetorical, acknowledging "constraints, competing possibilities, audience factors, and purposes… an innovative response to a perceived situation" (Newcomb, 2012, p. 594). For us, these components include stakeholder commitment, collaboration, and interdisciplinarity as well as five factors we discuss below: flexibility, situatedness, funding constraints, legal issues, and scholarship.

Flexibility

Flexibility undergirds everything in the CS-TC program. The program's culture of flexibility is facilitated by regular faculty meetings. Over the ten years, we have had to explain our disciplinary positions and find workarounds, sometimes resolving that "good enough" was indeed a win-win situation. One of the most visible areas of flexibility in response to change exists in technology, with the program adopting new technology as attitudes and affordances evolve (Clark & Andersen, 2005; Duin & Tham, 2020).

Three examples suffice to demonstrate the importance of flexibility to sustainability. First, in the Early Years, some students focused on CS coding, neglecting their TC effort while other students focused on their TC documents and presentations, assuming they already knew how to code. Administrators and instructors agreed that students needed to pass both courses each term in order to earn credit and to meet their graduation requirement. Second, in the Middle Years, the faculty introduced a usability module that was adopted for all sections, reinforcing a critical competence in both CS and TC. Third, in the Established Years, faculty have addressed issues of IP as the client-based projects have become more challenging.

Situatedness

As James Paul Gee (2004) noted, "we have general expectations about how our language is normally used," but "in actual situations of use, words, and structures take on much more specific meanings"— what Gee called "situated meanings" (p. 21). We argue that situated courses, with a discipline-specific focus, help students better prepare for long-term work in professional environments. They learn common language patterns of that profession as well as "social practices [that] have implications for inherently political things like status, solidarity, distribution of social goods, and power" (p. 21), all of which affect the ways they interpret and create artifacts. Students become members of a community of practice, "people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger 2011; Wenger & Snyder, 2000). This interaction is part of situated learning, valuable because, as Jean Lave (2009) explained, "Situated activity always involves changes in knowledge and action, [which] are central to what we mean by 'learning'" (p. 201).

Understanding the situation is important if a program is to be sustained, and one useful way to think about the situation is to borrow the taxonomy developed by William Condon and Carol Rutz (2012) to describe WAC programs. Their generative taxonomy (foundational, established, integrated, and change agent) characterizes various kinds of

interdisciplinary programs, drawing attention to programmatic goals, funding, structure, application, and assessment. Each institution needs to determine its own commitments.

Funding Constraints

In our experience, although establishing the courses, managing institutional processes, and hiring/supervising faculty were conducted by program administrators, actually developing, revising, maintaining and sustaining these courses required significant additional time and labor. Most of our programmatic development was accomplished by term-limited postdoctoral fellows (on the TC side) and non-tenure-track lecturer faculty (on the CS side). In all cases, developing this course sequence occurred in addition to the already heavy work of teaching these and other courses.

All the accomplishments discussed here occurred without funding beyond the existing postdoc and lecturer lines. At the same time, though such a program can be constructed "on a shoestring," that doesn't mean that such a program should be. The ingenuity described in our case study didn't occur because of the lack of funding; it happened in spite of it. Course releases, administrative support, or a coordinator hired in 2014 rather than 2019 (all of which were argued for at the time, unsuccessfully) would have made the development process less time-intensive and less stressful.

Legal Issues

Legal issues frequently need to be addressed in sustaining client-based courses that cross disciplinary as well as academic–industry–community boundaries. One of the most common issues involves IP (intellectual property). Although the client's IP includes the idea for the project and any data provided, students' IP includes anything that they code. However, students typically do not understand how IP works, so CS-TC faculty explain IP in class and provide explicit activities and assignments for students to learn about IP as well as other legal concepts, including non-disclosure agreements (NDAs), MOUs, work for hire, and paid research. Even though summaries are provided in class, only a lawyer can advise students about their individual rights. Basic information about IP and MOUs has been built into the CS-TC program. Georgia Tech has an academic unit (Create-X) whose mission supports students' entrepreneurial initiatives, so at least once per semester this unit provides access to legal resources to students who are developing startups. Advice from these external attorneys is available to students in the CS-TC program.

To submit a project, clients must sign an agreement to comply with these CS-TC program policies:

- The projects are designed and implemented by a 5-person team of CS students. Students select and bid on projects. Proposing a project is not a guarantee that a student team will select it.
- Students do not provide a warranty or maintenance for the software applications developed. After customer delivery, no guarantee exists of further support for the software. Requests for further development and enhancements can be conducted between the client and the student team.
- Students—not faculty—are responsible for developing the requirements and for scoping the project; therefore, the client must communicate with the team if a project is selected.
- To propose a project, a client must provide a one- or two-paragraph description of the project including any specialized skills needed on day one of the project. The clients must provide the name and email for the person serving as the primary contact for the students.
- The IP rights to the software are handled between clients and students. Georgia Tech claims no ownership of student work.
- The client must agree to provide guidance to any student team(s) throughout the two-term project. Though students are responsible for establishing and maintaining contact, the client must respond to reasonable student correspondence and feedback requests in a reasonable time. The client must also agree to provide feedback about the performance of the student team(s) to course instructors each term.

Clients who comply with these policies tend to become long-term stakeholders in the CS-TC program.

Scholarship

Even though the primary mission of the CS-TC program is teaching, faculty research and scholarship are also critical. As Ernest L. Boyer (1990) argued more than 30 years ago, teaching is an appropriate subject for research, a position that has given strong support for the scholarship of teaching and learning (SOTL).

SOTL systematically investigates questions related to student learning for teachers to improve their own teaching and also to advance the teaching of others (Kern, et al., 2015), a practice supported by our program. A number of CS-TC administrators and faculty have presented and published scholarship with "the hope of making a difference" (Fleckenstein et al., 2008, p. 406). To date, faculty in the program have generated dozens of local, regional, national, and international SOTL presentations and numerous SOTL publications on academic blogs as well as in refereed proceedings, edited collections,

and peer-reviewed journals that refer to the program as an example or provide detailed discussion of some aspect of the program. (See a list of the nearly 60 program-related presentations and publications; CS-TC Scholarship, 2022). Our case study provides an in-depth description of a single program that is part of a complex network in one institution. Because programs are "quite distinct from one place to the next" (Steinberg, 2015, p. 154), some believe programmatic case studies have a "perceived inability to generate theoretical insights beyond the case in question" (p. 152). We pose an alternative perspective: generalization does not necessarily need to suggest broad applicability, predictability, or transferability; instead, generalization can "focus our attention on the practical challenge of moving from the facts at hand to broader claims" (p. 153). We believe re-focusing attention is one of the enormous values of case studies. Though local networks are distinct, the categories of actors exist from one network to the next, so we can strengthen our understanding of one network by learning about ways in which another network functions.

Although our case study has been organized around four key success factors (stakeholders, collaboration, interdisciplinarity, and sustainability), we recognize that building and maintaining common ground and encouraging program responsiveness emerge as central to all four factors. Thus, we conclude with a series of questions that programs or program administrators might respond to as they begin conversations with another program or seek to expand or enrich existing TC programs. The usefulness or appropriateness of a question depends not only on the demographics of the student population and the resources of the institution, but especially on the phase of development in a program.

Building and Maintaining Common Ground

Creating an integrated, interdisciplinary program requires finding common ground—that is, areas of mutual concern or interest. The purposeful and intentional process involves intense intellectual and emotional labor, with attention to disciplinary criteria, pedagogical philosophy and praxis, workplace expectations, and teaching pairs (Hutter & Lawrence, 2016). The following questions might help your program work towards building common ground with stakeholders in your network:

- Who are your stakeholders, what motivates them, and what is needed to identify common ground with them?
- Once stakeholders join your project, what is the common ground between you and them? How do you and your stakeholders develop and maintain common ground? How might the departments/

units involved understand interdisciplinary collaboration?
- What do you know/assume (and not know/assume) about the other discipline's pedagogical, administrative, epistemological, and cultural differences, and are you willing to have those assumptions challenged towards building common ground?
- How can professional development support your interdisciplinary faculty and programmatic collaboration?

Encouraging Responsiveness

Creating an integrated, interdisciplinary program also requires programmatic responsiveness—that is, attention to attitudes and actions that are needed to make things work. The following questions might be useful as you consider your program's readiness and responsiveness with a view towards sustainability:

- What interdisciplinary framework(s) will the program use for creating, building, and sustaining curricular practices?
- How well are stakeholders and programmatic units prepared to respond to challenges (e.g., identifying common ground, planning to meet programmatic needs, leveraging resources, managing conflict, navigating complexity, and maintaining responsiveness)?
- How can you identify and access the resources needed to create, build, and sustain a program?

We encourage readers to use the case study not as a roadmap so much as a felt sense that integration and interdisciplinarity are possible. The case encourages beginning with thinking, planning, and piloting rather than jumping into action. We hope readers consider ways to use the concepts in their own situations, redefining common practices (e.g., as we redefined productive class size) and developing workarounds (e.g., inviting postdoc coordinators until funding was available for a permanent coordinator). Even when the challenges are abundant, the case provides evidence that successes exist, for example, moving to new ways of thinking about collaboration with colleagues, to shared workspaces, to different approaches to concepts.[4]

[4] Organizational change signals both political and pedagogical evolution. In August 2022, Georgia Tech's College of Computing announced the launch of its School of Computing Instruction (SCI)—formerly the Division of Computing Instruction (DCI)—responsible for teaching all 1000- and 2000-level courses in CS, as well as some upper-division CS courses, such as those discussed in this article (CS 3311 and CS 3312). In announcing this change, Charles Isbell, Dean, and John P. Imlay, Jr., Chair of the College of Computing, explained that, in addition to teaching, SCI faculty "produce new scholarship and techniques that expand everyone's ability to both teach and learn computing" (Claycombe, 2022). This organizational change will influence faculty responsibilities and the role of the CS-TC coordinator as well as the relationship with the Writing and Communication Program. Colleges and universities initiating interdisciplinary programs should anticipate similar organizational changes that necessarily influence the development and direction of their programs.

Thus, we hope the contextual narrative of our case study becomes a stimulus for conversation, focusing attention on concerns relevant to any institution considering collaboration and interdisciplinarity as foundational for an integrated program.

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Empowering Stakeholders in a Cohort of Interdisciplinary Writing Minors: Flexibility, Agency, Reciprocity, and Accountability

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Abstract. Universities and employers make clear that STEM students need to learn effective writing and communication strategies, and Technical/Professional Communication (TPC) programs are uniquely poised to facilitate this goal. However, in the absence of formal university Writing Across the Curriculum/Writing in the Disciplines (WAC/WID) structures, TPC faculty should be proactive in creating collaborative writing programs that can both serve their STEM students, and offer writing faculty opportunities to collaborate with a range of stakeholders. In this article, we draw from stakeholder theory to offer a heuristic and framework for analyzing stakeholders in an interdisciplinary writing program. We also draw from our newly developed interdisciplinary writing minors to model this framework and to define how it can help to ensure the flexibility, agency, reciprocity, and accountability that we argue are crucial to sustainable writing programs.

Keywords: Interdisciplinary, Stakeholders, Framework, Minors, Flexibility, Agency

Research has suggested that 80% of employers believe colleges/students should focus more on written communication (Hart Research Associates, 2013). For students in STEM fields, meeting this need requires providing students with broad rhetorical

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training as well as instruction in the writing practices of their specific discipline(s). Accordingly, many institutions have adopted formal infrastructures to facilitate writing across the curriculum(WAC) and writing in the disciplines (WID). However, what happens when no formal infrastructure exists to support WAC/WID?

From our perspective, technical and professional communication (TPC) programs, especially those without formal university support, need to be proactive in creating collaborative writing programs that can both serve their STEM students and offer writing faculty opportunities to collaborate with a range of stakeholders. We also believe that the most successful and sustainable multi-disciplinary programs need to exhibit four key characteristics: flexibility, agency, reciprocity, and accountability. At the University of Nevada, Las Vegas (UNLV), we considered these characteristics as we finalized three new interdisciplinary minors—Science Writing, Technical Writing, and Professional Writing—in collaboration with colleagues in the Colleges of Science, Liberal Arts, Engineering, and Allied Health.

Grounding Our Program Design

Our approach to designing and developing our cohort of interdisciplinary writing minors grew from our particular institutional context, which we describe in the following section. However, in building successful and sustainable multi-disciplinary programs, all colleges and universities can benefit from the four key characteristics: flexibility, agency, reciprocity, and accountability. Inspired by the work of Meredith Johnson, W. Michelle Simmons, and Patricia Sullivan (2017), these four characteristics guide our inquiry and ground our thinking for our "programmatic work." Moreover, they represent a vocabulary for articulating our goals. Although we acknowledge that these terms have a long, rich, and (sometimes) varied history in technical communication (TC) research, space requires that we define them simply within the context of our multi-layered, multi-disciplinary program.

Flexibility in our program allows us to adapt to the goals and needs of our stakeholders by designing a curriculum that allows courses from different majors to fulfill the requirements or by creating recruiting materials that convince administrators in disparate disciplines such as engineering, science, nursing, and the liberal arts to see value in and encourage students to pursue our writing minors. Avoiding program rigidity provides opportunities for input and development from all stakeholders, thereby giving them a voice and a sense of agency in contributing to the success of these minors. In our experience, too many programs are unwilling (or unable) to adapt their writing

programs to the needs of other programs. In contrast, we want our program's stakeholders to contribute so everyone benefits from of those contributions. This flexibility and resulting reciprocity may not be fully quid pro quo, but we believe that we can find different ways for stakeholders to engage and fundamentally help the program grow. Their contributions means that stakeholders must be accountable to establish certain expectations for the program (and each other). Thereby, the program works to apply measures that ensure those reciprocal expectations, as well as expectations for program quality, are met, whether those measures are workshops for instructors, student and faculty reflections, and/or program-wide and course-driven assessment strategies. These four characteristics influenced our thinking when we designed our curriculum, created recruiting materials, collaborated with writing and disciplinary faculty, and planned our short- and long-term assessment practices.

For a writing program to display these characteristics, the WPA must effectively engage stakeholders, and the design of our interdisciplinary minors commits to meeting stakeholder needs to ensure sustainable partnerships. In this manuscript, we provide a brief overview of our multidisciplinary program that offers training in specific rhetorical strategies to emphasize audience, translation, persuasion, and disciplinary discourse practices, paired with discipline-specific courses that help students apply rhetorical training to situations they will encounter as professionals. We then draw on stakeholder theory to construct an analytical framework that situates stakeholders, analyzes their goals and needs, and articulates the complex relationships that grow organically in a multi-layered and multi-disciplinary program. Finally, we provide an abbreviated sample analysis from our program.

Our primary goal is to model the flexibility necessary for similar programs in different academic environments, along with strategies for fostering "a shared social value of writing" (Arduser, 2018, p. 20) among stakeholders. Although our program design starts with a strong collaborative foundation (Harding et al., 2020), we acknowledge that moving forward does not require full agreement or perfect harmony; as long as all stakeholders have a voice, an interdisciplinary writing program can be sustainable and flourish over time.

Describing the Design of Our Cohort of Interdisciplinary Writing Minors

The interdisciplinary writing minors developed at UNLV serve students in STEM disciplines who wish to further develop writing skills for success in coursework and the workplace as well as English majors

who desire an applied avenue for their interests in rhetoric and writing. Ultimately, we proposed three separate interdisciplinary writing minors: technical writing, science writing, and professional writing. At present, as we followed the collaborative development process described in this article, these minors are poised for final approval process through the university system's curricular mechanism, with an anticipated date of formal activation in Fall 2023. After being approved, these programs will be housed formally in the UNLV Office of the Provost, and their administration (program coordinator and administrative support) will rotate between collaborating departments. Although we initially envisioned these minors as tailored to particular disciplinary cohorts—considering, for instance, engineers as an ideal audience for the technical-writing minor and life science students as particularly suited to the science-writing minor—we also wanted to ensure that the minors would be flexible enough to welcome students across major disciplines.

In line with guidance for developing programmatic outcomes in TPC programs from Geoffrey Clegg et al. (2021), the design and structure of our minors and the courses they encompass respond to both broader disciplinary trends in technical, science, and professional writing as well as the unique local and institutional conditions in which our program operates. These conditions offer both unique opportunities and constraints that guided us in thinking about the minor structure. At our institution, the English department and the broader BA degree historically have been dominated by a literature-oriented approach. In some ways, this relegated rhetoric and writing courses generally, and TPC courses specifically, as electives for majors, as service courses for other disciplines like engineering and business, and as components in potential concentrations that students could add to their majors. Furthermore, this meant that our faculty and courses had long considered and accounted for the myriad external audiences (students and administrators beyond English students) who might benefit from explicit training in rhetoric and writing. As a result, one unique strength that we considered when designing these minors was these established courses in professional writing and technical writing. This extant structure ensured that the faculty and approved courses required from the writing program were already supported and well suited to meeting the needs of interdisciplinary audiences. Similarly, UNLV's policy permitting students to "double-dip" in counting courses—i.e., allowing students to count a course toward both major requirements and a separate minor—allowed us to build a minor structure that would not impede students' progression toward graduation. Given the emphasis

at most institutions, including UNLV, on retention, progression, and graduation, course credits and minor requirements were an early pragmatic concern.

Structurally, each minor requires 18 credit hours. These hours include four courses, or twelve credits, from those offered in the English department and two courses, or six credits, from collaborating disciplinary departments outside English. The former hours include courses that offer training in specific rhetorical strategies, attending to issues of audience, translation, persuasion, and disciplinary discourse practices. The latter hours include courses designated to writing and/or disciplinary literacy emphases—i.e., the "ways of knowing" that characterize a field—offering discipline-specific, authentic writing tasks that help students apply rhetorical training to situations that they may encounter as professionals in their specific disciplinary spaces. Each collaborating program is responsible for determining (with support from writing faculty) which courses to designate as fulfilling the disciplinary minor writing requirements. This affords each department agency in determining both the disciplinary content, genres, and discourses to emphasize as well as the ability to proactively address pragmatic issues like prerequisites and curricular bottlenecks.

All courses are offered cyclically, ensuring that students can complete the minor in a 2-year period, and the courses approved to fulfill the requirements of each minor also dovetail with courses counting toward requirements or electives from other majors. Again, this ensures that the pursuit of a minor, even late in a students' coursework, will not impede their progress toward graduation and may encourage students to consider the minor upon realizing they have already taken courses that will count toward that minor.

Overall, the interdisciplinary writing minors are intended to provide students with the knowledge, skills, and practice necessary for effective writing in particular professional and disciplinary contexts. In all minors, students practice pure and applied qualitative and quantitative research in multiple genres and for both lay and expert audiences. Courses and activities are designed to encourage both durable conceptual understanding and attention to students' development as writers fluent in the discourse practices of their disciplinary spaces.

For each minor, students are required to take the designated foundational course from the English department (e.g., Foundations in Professional Writing; Foundations in Technical Writing; Foundations in Science Writing), and then select from other writing and rhetoric courses such as Document Design, Visual Rhetoric, Electronic Documents and Publications, Writing Grants & Proposals, Writing &

Presenting Academic Research, Technical Editing, and Advanced Professional Communication. The curriculum for each of these writing and rhetoric courses are flexible enough to allow students to bring different disciplinary emphases to the courses' required work. Courses drawn from outside departments (again, determined by the collaborating department) range from introductory surveys with writing components to upper-division, writing-intensive courses as well as major capstone courses in which students produce a polished written product.

Building a Framework for Analyzing Stakeholders in Writing Programs

Although we have established a general curricular and programmatic description of our interdisciplinary minors, we believe that creating a long-term collaborative and sustainable writing program requires that the program exhibit those four characteristics: flexibility, agency, reciprocity, and accountability. To do this, a WPA must conduct an in-depth examination of potential stakeholders. Again, an effective interdisciplinary writing program is untenable without the buy-in of (and collaboration with) stakeholders from across campus; and it will not flourish without an understanding of stakeholders: who they are, what their goals and needs from the program are, and how these complex relationships grow organically, especially in a multi-layered and multidisciplinary program.

To aid in this analysis, we created a framework using features from stakeholder theory for analyzing potential stakeholders in a writing program. This framework allows us to examine and articulate stakeholder relationships as programmatic relationships and then to develop sustainable pathways to promote flexibility, agency, reciprocity, and accountability in our program. This framework ideally provides each stakeholder with a sense of commitment and co-ownership to an interdisciplinary writing minor.

Stakeholder theory, as a direct ethical response to shareholder theory, posits that a business cannot achieve true and long-term prosperity if it fails to consider the needs of all parties, or stakeholders, with a vested interest in the success of the organization (as starting points, see Freeman, 2008; Freeman, Harrison, & Wicks, 2007). The vast majority of stakeholder-theory research occurs in business and management fields, but recent applications have started to appear in some areas of technical and scientific communication. Even though academia does not need to account for shareholders in the same ways that businesses

do, the ethical considerations that arise from the competing interests of stakeholders in a writing program are equally valid. In considering the application of this theory to higher education, Jim Nugent and Laurence Jose (2017) pointed out that, although "… a few commentators have performed a sort of stakeholder analysis of academic programs…, these analyses do not go very far beyond basic stakeholder identification" (p. 19). Our goal in stakeholder analysis, therefore, is to provide the tools for WPAs to go beyond basic stakeholder identification and identify the value of those stakeholders and establish collaborative relationships with them.

To build a framework for analyzing stakeholders in a writing program, we begin with methods introduced by R. Edward Freeman, Robert Phillips, and Rajendra Sisodia (2020), who argued that the key is "'knowing how'' to engage stakeholders and create value for them, rather than the technical 'knowing that' such and such is the case for all firms for all times for all problems for all configurations of stakeholders" (p. 217). Acknowledging the contextual nature of stakeholder and programmatic relationships is an important distinction for us and means that an analytical framework must account for previous histories, current situations, and future promises at the local level. Effective writing-program development is not one-size-fits-all but instead should grow organically out of the local environment, which means that our analytical framework must discern the necessary rhetorical insights to place stakeholder needs and goals in the context of the program.

Initial Steps for Building a Stakeholder Analysis Framework

To offer concrete steps for producing a more comprehensive stakeholder analysis, we start with three key themes identified by Fran Ackermann and Colin Eden (2011):

1. Identifying who the stakeholders really are in the specific situation (rather than relying on generic stakeholder lists);
2. Exploring the impact of stakeholder dynamics; and
3. Developing stakeholder management strategies. (p. 180)

A key tenet of stakeholder analysis is to go beyond simple identification, so these themes represent the important information that an analytical framework must generate for a WPA.

Because "organizations are obligated to take into account the voices and viewpoints of those parties poised to affect (or be affected by) the organization's actions" (Nugent & Jose, 2017, p. 19), the WPA must first list all potential stakeholders. For our own process of stakeholder identification, we began by brainstorming a robust list, with a belief that "who stakeholders are is related to the multifarious nature

of the demands they can make on the organization" (Ackermann & Eden, 2011, p. 179). A more robust list, we believe, will lead to a more comprehensive understanding of the various relationships that stakeholders have with our program.

In going beyond simple identification, we realized and knew we needed to address that some stakeholders have legitimate claims on a writing program, some have urgent needs at different times, and some have power over program operations and resources (Carnegie & Crane, 2019). As Donizete Beck and Jose Storopoli (2021) pointed out, "These attributes matter for managers to classify and prioritize some stakeholders taking into account their context, and then, making better decisions on resources allocation and time spending" (p. 2). Whereas some stakeholders may have more legitimate claims, more urgent needs, and more power over operations and resources of the program, we also determined that the situation was illogical when one group of stakeholders has salience at the exclusion of other stakeholders. As R. Edward Freeman (2010) stated, "If you take away the support of any stakeholder you simply do not have a viable business" (p. 7). Thus, we felt compelled to account for the needs of *all* stakeholders, so that they are treated equally, given a voice, and provided a legitimate outlet for engaging.

Although the focus of the framework is to analyze stakeholders, we emphasize that this analysis is always in the context of a writing program, which includes both human and non-human influences (Luoma-aho & Paloviita, 2010), and is always per what the program offers the stakeholders and what the stakeholders offer the program. Without understanding that these goals are always embedded in the context of the writing program, the WPA cannot make effective choices for program success, now and in the future. WPAs must manage stakeholders effectively to achieve program success. In managing, the key to go from analysis to action is the "binding idea" (Freeman, 2010, p. 7) whereby the WPA constructs a "jointness" of interests among and between stakeholders to establish the means for long-term strategic relationships to the program. It is in these long-term strategic relationships that writing programs can "create the best possible outcome for as many salient stakeholders as possible" (Nugent & Jose, 2017, p. 23). For the information to fit seamlessly within the larger writing program context, the WPA conducting the analysis should keep in mind three interconnected ideas underscored by Freeman (2010):

1. No stakeholder stands alone in the process of value creation.
2. The primary responsibility of the executive is to create as much value as possible for stakeholders.

3. Stakeholders have names and faces and children. (pp. 8–9)

Acknowledging that stakeholders are an active part of the larger context of a writing program means that value creation is never isolated and never acontextual, because what benefits one group of stakeholders could easily harm or exclude a different group of stakeholders. Accordingly, our stakeholder analysis framework must account for the ethical responsibility of WPAs to all stakeholders in the program.

Our stakeholder analysis framework takes its cue from Elina Jaakkola's (2020) "model," from which we build a framework that explains and predicts relationships, identifies new and possible long-term connections between stakeholders and the writing program, introduces the value of new and previous relationships, and considers and predicts why a sequence of events might lead to a particular outcome (p. 24).

Our Stakeholder Analysis Framework: Going Beyond a Simple Identification

Our stakeholder analysis framework begins with a set of heuristic questions that generates key information about each of the stakeholders connected with a writing program. As a starting point, we found this heuristic to be the most adaptable for other writing programs and other contexts. The heuristic questions include the following:

- What is the name the stakeholder? (Offer a brief definition; if the stakeholder involves a group or organization, list a primary contact.)
- What is the academic role on campus of the stakeholder? In this role, what are the stakeholder's short- and long-term goals? Can the goals of the stakeholder be met (or helped) by a writing program?
- Overall (beyond the role in the previous question), what are the short- and long-term needs of this stakeholder? Can they be met (or helped) specifically by a writing program? In the short-term? In the long-term?
- How would the stakeholder define success in their work? How would they define success on a daily basis? Can the success of the stakeholder be improved (or helped) by a writing program?
- What value does a writing program offer this stakeholder?
- What value can the stakeholder offer to a writing program?
- What are the specific features of a writing program important to this stakeholder?
- What power might this stakeholder have over a writing program's operations or resources? What power might this stakeholder have over a particular feature (or aspect) of the writing program?

- What claims might this stakeholder have on a writing program? What claims might this stakeholder have on particular features of the writing program?
- What might the stakeholder gain from the success of a writing program? In the short-term? In the long-term?
- What relationships might the stakeholder have with other writing program stakeholders? How might those relationships affect the success of the writing program?

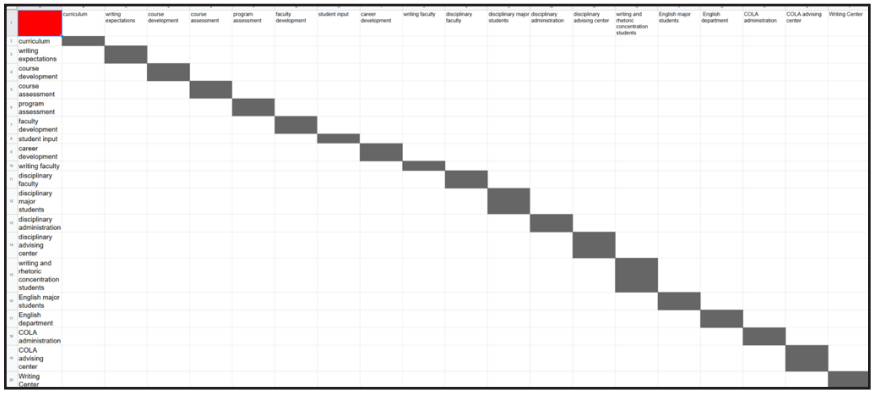
Using the heuristic and responding to each question for each stakeholder to gather initial key information, the WPA then puts that information in the context of the writing program. To do this, we created a relational table as a next step to map out the ways that each of the stakeholders interact with key features of the program and with each other.

Table 1 offers a simple 4 × 4 matrix as a template. On the surface, a table like this can show simple connections between a stakeholder and key features of the program, as well as potential relationships between and among the other stakeholders. A relational table like this may appear repetitive; however, this design allows the WPA to look at issues important to program development from different angles. The relationships become more apparent when reviewing an actual program table. Our current spreadsheet, shown in Table 2, is 19 × 19 with 11 stakeholders and eight key program features: 1) curriculum, 2) writing expectations, 3) course development, 4) course assessment, 5) program assessment, 6) faculty development, 7) student input, and 8) career development).

Table 1. Relational table template

	Program Feature 1	**Program Feature 2**	**Stakeholder 1**	**Stakeholder 2**
Program Feature 1				
Program Feature 2				
Stakeholder 1				
Stakeholder 2				

Table 2. Sample Program Spreadsheet



A spreadsheet like these (Tables 1 and 2) can provide more complex insights, allowing WPAs to see where key components of the program align with specific stakeholders and where stakeholders may have common goals or needs, based on their relationships with other stakeholders. More importantly, this spreadsheet allows WPAs to also see at a glance where competing interests might arise in specific areas of the program. (We offer an example in Table 3 that provides more context.)

Effectively engaging stakeholders to model the four key program characteristics of flexibility, agency, reciprocity, and accountability is the central goal for this analytical process. In the next two sections, we offer a few brief examples of our own stakeholder analysis using this framework.

Analyzing Stakeholders in a Cohort of Interdisciplinary Writing Minors

We show how our stakeholder analysis both articulates programmatic relationships and informs our understanding of how the design of our cohort of interdisciplinary writing minors can best meet stakeholder needs. The analysis also informs us how to develop programmatic pathways that allow each stakeholder to gain a sense of co-ownership and commitment to an interdisciplinary writing minor and ensure sustainable partnerships.

We have divided the framework into two parts:

Framework Part I: Individual Stakeholder Analysis

Our stakeholder analysis begins with a heuristic that encourages

movement beyond simple identification of stakeholders to consider their interconnected roles in the process of value creation (as illustrated in Table 2). In particular, we posit this process as a way to conceptualize how our interdisciplinary writing minors (and, by extension, those engaged in WPA work more broadly) can foster sustainable and flexible relationships and structures to benefit all stakeholders.

In this section, we offer an example of this analysis in the context of the stakeholders identified in our process of minor development. These included the following broad categories, which are specific to UNLV but are likely representative of the cohorts of stakeholders with whom many WPAs engage:

- Writing faculty
- Disciplinary faculty
- Disciplinary major students
- Disciplinary administration
- Disciplinary advising centers
- Writing and rhetoric concentration students
- English major students
- English department
- College of Liberal Arts (COLA) administration
- COLA advising center
- Writing center

We want to emphasize that we do not advocate for "lumping together" these groups in an analysis—indeed, understanding the unique circumstances of each (and the variety that can exist even within a particular group) is central to the process that we propose. However, for the purposes of modeling the heuristic, we have selected specific stakeholders within the broader "umbrella" categories of students, faculty, administration, and student support. In particular, we offer as examples our analysis of disciplinary major students, writing faculty, disciplinary administration, and the COLA advising center. As our analysis indicates, a WPA cannot apply this heuristic for any one group without considering how that group is situated within the broader ecology of the community, the university, and the writing program. However, as we demonstrate in the next section, this initial analysis enables us to visualize the ecology as a whole, including key spaces of both mutuality and tension. Thus, we provide analyses of four potential stakeholders: biology students, writing faculty, the dean of engineering, and the campus advising center.

Sample Analysis: Biology Students as Stakeholders

To provide an example of application, we consider the groups representing student stakeholders and using as an example our heuristic

applied in the context of disciplinary major students—i.e., students outside the English major who are pursuing our interdisciplinary-writing minor as a way to strengthen and augment their writing skills in the context of their own disciplinary communities. Although some student concerns are universal—that is, all students are concerned with fulfilling the requirements of their majors, progressing to graduation, and developing the skills and knowledge to enter and succeed in the workforce—other concerns and characteristics within this broad category will vary based on students' specific affiliations. Even within the limited category of disciplinary students, given the range of our interdisciplinary minors (spanning students across majors and colleges), we cannot assume, for instance, that the analysis will be the same for students majoring in engineering (or even a particular sub-field of engineering) as it will be for students majoring in biology. That said, for the purposes of modeling, we will use the biology major.

At UNLV, biology majors are housed within the School of Life Sciences in the College of Sciences. Students with a BS in Biological Sciences can concentrate in one of five areas: cell and molecular biology; ecology and evolutionary biology; integrative physiology; microbiology; and pre-professional studies; each area requires 76–78 credit hours with no more than 9 credits of general electives available in any degree plan. Logistically, students in the biology major are limited, beyond the general education requirements that exist external to their major, in their ability to take significant coursework outside their college. Because of these limitations and the prerequisite courses in place for their major coursework, students who are biology majors are limited in their timeline, such that failing to successfully complete a particular course early in their course load could delay their progress toward graduation.

Despite the heavy disciplinary requirements, however, success in many courses—including the early survey—require students to engage in scientific writing, including the Claim, Evidence, Reasoning (CER) model (McNeill & Krajcik, 2011), for which many students are not prepared. Likewise, students' ability to translate their disciplinary expertise to lay audiences—explaining the value of their degree to a potential employer or communicating complex scientific concepts and findings to the public—are skills that students understand as necessary to professional success yet that are not necessarily addressed in their major courses. Thus, the interdisciplinary science writing minor can help biology students succeed in their coursework and situate

them as more attractive candidates for jobs and advancements in the workplace.

In designing the minor, we were mindful to establish course requirements in such a way as to dovetail wherever possible with existing requirements. As contributors to and stakeholders in the interdisciplinary science-writing minor, these students bring clear and relevant examples to illustrate the value of such endeavors and become themselves ambassadors for the minor through their successful engagement (e.g., for instructors in their major who find students better prepared to engage in classroom writing assignments and for employers who can appreciate both scientific expertise and the ability to tailor information to different audiences).

Sample Analysis: Writing Faculty as Stakeholders

Next, we apply this heuristic to a faculty group—in this case, writing faculty. At UNLV, writing faculty are housed in the Department of English, where they comprise a minority in a department that otherwise is focused largely on literary studies.

Historically, writing faculty have aligned with the subdisciplines of composition studies and of technical and professional writing. Although writing faculty are trained in rhetoric, most "traditional" rhetoric courses at UNLV (e.g., Rhetorical Theory; Rhetorical Criticism) are taught in the Department of Communication Studies, which is housed in a different college at UNLV. As a result, although rhetoric is infused throughout writing courses, it tends to be positioned in a more applied, rather than theoretical, context that situates interdisciplinary minors—which foreground application and connection—as an ideal platform.

Generally, writing faculty have a vested interest in the growth and success of writing programs, and, although interdisciplinary minors offer an opportunity to collaborate with faculty across programs and colleges, increase enrollment in existing writing courses, and provide space to develop new courses (like science writing), these interdisciplinary courses may not (at least initially) be sustainable as courses for only English majors. As contributors to the minor, writing faculty then play a central role in the creation, implementation, and marketing of these courses and of the minors.

Sample Analysis: College of Engineering Administration as Stakeholders

Third, we apply this heuristic to analyze administrative stakeholders and use disciplinary administration—specifically, the Office of the

Dean for the College of Engineering—as a model. Whereas any dean's office has a vested and implicit interest in student success, the office's mandate also includes "big picture" concerns regarding staffing, funding, accreditation, sustaining/growing enrollment in the college, supporting faculty success, and aligning with broader university initiatives as identified by the provost's office. (At UNLV, these concerns include ongoing initiatives related to diversity and inclusion, research expenditures to support our top tier initiative, and other challenges.)

With regard to the dean's office, administration appreciates the value of writing for their students, both as central to their students' success as undergraduates as well as future employees in industry. At UNLV, this commitment is evidenced through the dean's past support of the concentration in professional writing, which many students in engineering elect as a complement to their engineering degrees. Given UNLV's emphasis on maintaining its recently achieved R1 status, the engineering administration also values the opportunities for interdisciplinary collaboration for engineering faculty, particularly as collaborations may support future extramural funding (in the form of interdisciplinary research projects as well as writing support for their faculty members).

Sample Analysis: College of Liberal Arts Advising Center as Stakeholders

Finally, we consider the COLA advising center (at UNLV, the Wilson Advising Center). As is true for campus advising centers, two of the primary goals of the COLA advising center are 1) to ensure that students have the information that they need to make informed choices about their courses and degrees and 2) to provide guidance to influence and improve student retention, students' progress toward graduation, and student completion of their degrees in a timely manner.

Advisors also bear some responsibility for helping students to understand how particular degrees align with the job market and with students' plans following graduation. COLA advisors thus recognize the value of strong writing as a stand-alone skillset and as a supplement to specific liberal arts degrees, some of which (like English) may not have as clear and delineated a career trajectory as students graduating in disciplines like engineering and computer science. At a more formative level, advisors play a crucial role in making students aware of the interdisciplinary writing minors in the first place, including how, specifically, they can dovetail with other courses and programs.

As contributors to program development, they also play a central part in early identification of courses for inclusion. The advisors offer broad knowledge of how and where particular courses can count,

potential logistical bottlenecks (e.g., pre-requisites, course rotations), and insight from student experiences. As gatekeepers of sorts for student enrollment, they further highlight the need to clearly articulate the degree requirements; though all majors provide a clear degree worksheet with a checklist for students' degree audits, logistical challenges in advising can occur when the major's degree worksheet does not clearly align with the options for a designated minor.

Framework Part II: Relational Stakeholder Analysis

With the basic stakeholder information developed from the heuristic, the next step for a WPA is to put that information into conversation. In other words, a WPA cannot leave the stakeholder information isolated: a program will only flourish with buy-in of (and collaboration with) all stakeholders. Because our relational table provides a tool for analyzing stakeholder relationships within the program, as well as relationships between and among stakeholders, the WPA can develop the insight necessary for implementing key strategies that promote buy-in and encourage collaboration.

Stakeholder Relations: Key Table Features for Analysis

Because the analysis is always in the context of our writing program, i.e., within our interdisciplinary writing minors, our relational table begins with key features of the program. As noted above, our current analytical spreadsheet lists eight key program features that we believe are important for sustainable program development:

- **Curriculum:** As described above, curriculum involves the general structure of the minors, including the number of disciplinary courses and the number of English courses.
- **Writing expectations:** Each disciplinary course will operate from a negotiated writing expectation for the disciplinary course to be eligible to fulfill the expectations of a particular minor.
- **Course development:** Each course in the program will be developed collaboratively, with faculty including regular updates based on course and program assessments and faculty review.
- **Course assessment:** Each course in the program will be assessed consistently based on a set of program criteria developed collaboratively.
- **Program assessment:** The program will evaluate all course assessments, along with program-based assessment measures to improve course materials and delivery, student outcomes and workloads, and faculty workloads.
- **Faculty development:** The program will offer regular resources

and workshops to improve faculty workload and retention in the program.

- **Student input:** With course and program assessments, students will be asked to reflect on their experiences in each course, and the program will conduct regular focus groups and distribute an annual survey to give students a more effective voice in the program.
- **Career development:** The program will work closely with the different advising centers, as well as the university workforce leadership team, to improve career development opportunities for students in the program.

Space constraints limit us to offer brief descriptions of these features as examples, but each WPA should list and define the key features of their program to create a more robust table (as we model in Table 2). For a brief example, we provide Table 3, which uses the same stakeholders described in the previous section, but focusing on the program feature of "writing expectations."

Table 3. Sample relational table for program analysis

	Writing Expectations	Engineering Admin	Biology Students	Writing Faculty	COLA Advising
Writing Expectations					
Engineering Admin					
Biology Students					
Writing Faculty					
COLA Advising					

Stakeholder Relations: Brief Sample Using Table Features for Analysis

Because our goal is to analyze relationships and the impacts that the program has on stakeholders and vice versa, we use the top row (see Table 3) to indicate who or what has priority in a particular cell, which enables us to visualize spaces of both overlap and potential conflict. This location also prompts us to ask questions that can foster the kind of ongoing and reflexive process, which allows us to balance

stakeholder needs and concerns in a dynamic model. For instance, what might change if we prioritize writing expectations over the needs of the engineering administration? What happens if we prioritize the needs of writing faculty over the goals of biology students? If we focus too much on the advising center and less on the faculty? Many of the differences may be mere nuance; however, choosing the needs of one stakeholder may also have an adverse effect on another stakeholder or on the viability of a key feature of the writing program.

For engineering administration, writing expectations—i.e., which courses and content should be included and designated as fulfilling the technical writing minor—are guided by the genres common to the discipline and profession, the need to align with American Board of Engineering and Technology (ABET, one of the credentialing boards for engineering programs) standards and outcomes for accreditation, and human resources (i.e., faculty) to be able to offer and support writing-intensive courses. However, if a WPA emphasizes writing expectations that in some way are at odds with the engineering administration's goals for writing, then collaborating may become more difficult. For example, many of the ABET standards focus on the final product, but if a WPA wants to focus writing expectations for the program to ensure that all projects go through a writing process, then the WPA needs to have the necessary arguments prepared to get buy-in from the engineering administration. That is, the engineering administration must consider that the writing process is an important consideration in engineering courses.

For biology students, familiarity with common genres—and especially those (including the CER model) that they encounter in their courses—is likewise a priority, although these genres are markedly different from those common to engineering. Given biology students' highly regimented program of study, they care that the disciplinary courses designated as writing intensive be those that also count toward their major, rather than toward electives within their degree plans. The students' focus in considering writing expectations is shaped by course content and structure as well as a course's place within the broader major structure. In considering a biology course that counts toward the minor, if the WPA does not believe a particular disciplinary course is sufficiently writing intensive, that WPA might argue for a different course. However, if the new course does not count toward the major, then the course is not helping biology students complete their program in a timely manner. Stakeholders need to together consider these concerns.

For writing faculty, the minor courses offered in the English

department (aside from the minor-specific introductory courses) must offer training in rhetorical and writing strategies that can span disciplines and audiences, allowing the courses to serve both majors (including students focused in literature and in writing and rhetoric) as well as students enrolled in the class but pursuing other majors. These courses must also align with broader English major outcomes. Although meeting writing expectations is not necessarily a concern for the WPA with writing faculty, if priority is given to writing faculty to meet writing-intensive standards for an interdisciplinary writing program without input from the overall program or from other stakeholders, then other problems may arise for the program if the needs of disciplinary students are not met. Though writing faculty are beholden in part to the expectations of the English department and major, the reciprocal nature of the program design—itself defined by a flexible and mutual contribution from multiple stakeholders—enables this tension to be reconciled. The involvement of each stakeholder at key points, from formative design to future evaluative efforts, ensures accountability, and that accountability is further supported through the mapping structure modeled here.

For COLA advising (focused on students majoring in liberal arts), one priority is that courses designated as writing intensive and offered in other colleges (e.g., for an English major pursuing a minor in science writing) need to be offered regularly, in different modalities, and without prohibitive prerequisites. As with biology students, the understanding of writing expectations is thus guided in part by logistical concerns, rather than particular ideas about what specific content, genres, or practices are privileged.

This abbreviated set of examples demonstrates both the textured understanding that our heuristic and relational table enables, as well as the areas of potential tension that we argue can be negotiated through a commitment to flexibility, agency, reciprocity, and accountability, and facilitated through the analytical process we offer here.

Applying Stakeholder Information for a Sustainable Writing Program: Flexibility, Agency, Reciprocity, and Accountability

Although our model grew from our thinking about our specific technical and scientific communication program and our cohort of interdisciplinary writing minors, our framework can be adapted in a variety of contexts in which technical and scientific communication programs

operate. Our reasoning shows that, for other programs, an effective stakeholder analysis allows the WPA to glean the necessary insights that place stakeholder needs and goals in the context of the writing program to make effective choices for sustaining a program over the long term.

We have demonstrated that key program characteristics for effective program development and program sustainability are flexibility, agency, reciprocity, and accountability. The successful writing program needs accurate, honest, and well-rounded information to be truly flexible, to provide agency for all stakeholders in the program, to ensure that the contributions to the program are equally reciprocal for all stakeholders, and to ensure that stakeholders who contribute to the program are accountable (and acknowledged) for the long-term success of the program. For success, a WPA cannot build in program flexibility or flexible expectations without identifying new and possible long-term connections between stakeholders and the writing program, for flexibility is never defined the same throughout time for all stakeholders. Instead, flexibility must be contextual and must grow organically within the local environment. This contextual consideration proves true for stakeholder agency, as well. Agency is unattainable unless a WPA knows what is required in a flexible program design, how program features align with specific stakeholders, where stakeholders may have common goals or needs based on their relationship with other stakeholders, and where competing interests might arise in specific areas of the program. As noted in our examples, although the writing expectations of engineering administration and biology students differ in significant ways, the agency afforded to each college and department to designate appropriate courses enables the flexibility for both groups to chart courses through the minor that meet the needs of each. Likewise, to extend the engineering administration example further, if a WPA wants to ensure that projects in writing-intensive engineering courses go through a writing process, then the WPA might reciprocate by offering free faculty development that will both help engineering faculty deal more effectively with the paper load and, in the long run, improve their work/life balance (Nagelhout & Tillery, 2021). The reciprocal investment makes getting buy-in from faculty easier.

Our framework provides the information that can guarantee a voice for all stakeholders and encourages them to collaborate in program development because understanding the goals and needs of stakeholders provides the WPA with the knowledge to reciprocate accordingly across the program and establish standards so that

stakeholders are accountable to each other for the success of the program. A program design like ours depends on interdisciplinary collaboration among faculty and administrators to successfully account for logistical challenges related to credit hour limitations, curricular bottlenecks, and issues of retention and progression.

In conclusion, our stakeholder analysis framework clearly presents something that we have known: a full account of a writing program, with all of its messiness, and the hopes and dreams that arise from the myriad stakeholder relationships, can never be expressed in a single article. Instead, we have offered a glimpse into the design of our interdisciplinary writing minors and, more importantly, the ways that we use our stakeholder analysis framework to provide us with the depth of information that we need to make both strategic and effective choices to sustain the program over time. We plan to continue to research and refine our framework and further explore important program characteristics like flexibility, agency, reciprocity, and accountability. We anticipate that other WPAs will do the same.

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"Magical Thinking" and Inward Engagement at a Small Liberal Arts University in a Time of Crisis

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Abstract. This case study essay draws on experiences and survey documentation surrounding a new, client-driven course, ENG337–Professional Editing, that was piloted during the height of the COVID-19 pandemic. The author, an Assistant Professor at a small liberal arts college, pulls from this experience and the attending documentation to interrogate "magical thinking," a concept formulated by Joan Didion (2007) and later repurposed by James Dubinsky (2010) to explore various dimensions of program development. Throughthe narrative of course development and administration and a retroactive summary of survey findings, the author demonstrates how "magical thinking" can be re-formulated to respond to our responsibilities to students and stakeholders in times of crisis. The essay concludes by calling on readers to not allow "magical thinking" to be a just-in-time reaction, but rather a regular expression of our values in the field.

Keywords: Editing, Course Design, Client Engagement, Magical Thinking, Times of Crisis

Programmatic research encountered a *kairotic* moment with the onset of COVID-19. I use that term as Debra Hawhee (1998, 2004) would: to signal the notion of an "opportune moment" for rhetorical action—the proverbial grasping of *kairos* by the forelock before the moment is gone. In 2021, in response to the onset

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of the pandemic, this publication venue dedicated a special issue to COVID and the distinct programmatic problems associated with that moment. On social media and in our publication venues, instructors wrote about opportunities COVID introduced; we criticized those who sought, with different degrees of tact, "opportunities" during the crisis; we declared COVID itself the opportunity to discuss matters of disability, race, class, and entangled issues of social justice; and more than we'd like to admit, we struggled to align the priorities of our discipline and our commitments as academics, pedagogues, and administrators with the demands of this long (too long) moment. Yet, COVID remains present. The problems the pandemic outlined for us were not created by COVID and will not subside with COVID. Every day we should align our commitments as instructors and program directors with the demands of the present. COVID, I contend, just made our conversations about those commitments more urgent and values-based.

Although our field(s) could not immediately agree on the appropriate academic or programmatic lens for addressing COVID-19, we shared experiences that we knew required us to respond. Students were sent home *en masse*; classes were moved to remote or hybrid; childcare for faculty, students, and staff needed to be accommodated; campus technologies (for most) became unavailable; students and their family members became ill; students or their families were laid off or furloughed. In short, massive concerns distracted students from academic work. As a result, many administrators and faculty members adjusted their expectations and simply sought to get their students and learning process to the end of the semester. Moreover, communities that had formed around campus were fractured and needed to be rebuilt with the technology on hand (a scarce resource at many institutions), and the demands of the moment were to connect with students remotely and in diverse geographic locations, to meet them where they were, and re-orient them to what often felt like new courses with a slew of new, individual projects. How we addressed these demands—i.e., how instructors and administrators weighed the social and communal work of technical and professional communication (TPC) against the reality of the pandemic—reveals a lot about our often-conflicting commitments as administrators, faculty, and researchers alike.

One such struggle to align commitments as a program director, pedagogue, writer, and person subject to pandemic

conditions is the focus of this case study essay. Part narrative and part critical analysis of stakeholder engagement and editing pedagogy, this essay proposes an application and a rethinking of "magical thinking" (Dubinsky, 2010) that allows program administrators and TPC faculty to turn toward internal opportunities for engagement when external opportunities are scarce or unobtainable. In other words, though conversations around community and stakeholder engagement in TPC have a long and lively lineage (e.g., Batova, 2021; Bourelle, 2014; Henze, 2006; Kramer-Simpson, 2018), the following narrative indicates a need for programmatic scholarship that focuses on small programs, geographically isolated (i.e., rural) programs, new programs, and programs that, in the face of upheaval, rely on ad hoc and creative ways to bring stakeholder and engagement experiences to students.

"Magical thinking" is a concept lifted by James Dubinsky (2010) from Joan Didion's (2007) *The Year of Magical Thinking* and used as a baseline concept for "A *Techné* for Citizens: Service-Learning, Conversation, and Community." Dubinsky quoted Didion on the matter of grief: "you ha[ve] to feel the swell change. You ha[ve] to go with the change" (Didion, 2007, p. 3; in Dubinsky, p. 277). Dubinsky leaned heavily on these notions of change and suddenness and used both as controlling themes of his retelling of his work on building professional writing curricula. Dubinsky's vision of "magical thinking" is less severe as than Didion's strategy for addressing grief. It is a shorthand for describing the several rhetorical and material turns that shaped Dubinsky's program by calling on Dubinsky and his departmental collaborators to respond to them. "We discovered service-learning was a rhetorical strategy for gaining the university's heart," Dubinsky (2010) wrote, "which became central to our understanding of the structure for our program. It provided a means of building relationships through teaching and learning, which inculcated respect" (p. 293). Dubinsky's story is meant to be one of responsiveness. He responded to his institution's response to his pitch, which shaped the program. He responded to new-found allies and friends and to what he "discovered" along the way.

"Magical thinking" is, thus, a responsive activity, and it is not a groundless one. Program administrators know that certain principles (e.g., service, *praxis*, style) are non-negotiable in the successful administration of a TPC program and curriculum. Thus, "magical thinking," and the principles highlighted through it, should perhaps be reconsidered, given the recent reality of pandemic teaching. What follows is such a reconsideration via the story of a new TPC program and the pilot section of a co-created professional editing course. This experience and the course-related research indicate that Dubinsky's (2010)

"magical thinking" provides a rough strategy for approaching the uncertain as an instructor and/or administrator. However, only by fine-tuning this approach, accounting for both the velocity of change in our contemporary institutions and the need to hold onto the first principles of TPC curriculum and instruction, can "magical thinking" become a working heuristic in our present moment.

Dallas, PA, Misericordia, and Professional Writing and Rhetoric in COVID

Misericordia University is a Catholic liberal arts institution located in Dallas, Pennsylvania, a small rural town in northeastern Pennsylvania (NEPA). Locally, the town is considered a suburb of Wilkes-Barre, PA, in Luzerne County. Wilkes-Barre and Scranton constitute the metropolitan hub of NEPA. Like the rest of the nation, Luzerne County was hard-hit by the COVID-19 pandemic tracking national trends[1]. The course in question in this essay, Professional Editing, ran in spring 2021 and began as the region was on the downward trend from its (at the time) largest 7-day average of new COVID cases. (This spike would be eclipsed a year later by the Omicron variant.) By that time, faculty at the institution and students within the English department had become accustomed to a campus environment that shifted almost daily: varying masking, social distancing, testing, quarantining, and course delivery protocols tightened and loosened with each new revelation in case numbers.

Misericordia has largely followed other trends among Catholic liberal arts institutions, particularly austerity trends following declining enrollment. In fact, in response to enrollment trends over the previous several years, I was hired to remodel and relaunch a long-neglected "writing track" within the English major. The "writing track" operated as a hybrid TPC and journalism program since its inception in the 1990s, but demand existed—from administrators, department members, and students alike—to update the curriculum and course offerings. In short, the (at the time of my hire) looming pandemic, low institutional enrollment, and particularly low humanities enrollment created pressure cooker conditions to create *something* within the English department as quickly as possible. So, in fall 2020, as the pandemic conditions of education became normal, the newly branded "Professional Writing and Rhetoric" (PWR) track was approved as a formal TPC "track" within the English B.A.The revised program would not be formally

[1] For the purposes of this study—and given the largely commuter-based student body at Misericordia—it's useful to consider COVID numbers at the county level.

instituted as part of the academic catalog until the following academic year (AY 2021-2022). Still, it marked a substantial cultural shift within the English Department. A side-by-side curricular comparison between the former and current "track" requirements demonstrates a major redistribution of skills and experiences for TPC undergraduates:

Table 1. Comparison of credit distribution between Misericordia's former "writing" track and the relaunched "professional writing and rhetoric" track

	"B.A. English – Writing" (circa 1990 through AY 2020 – 2021)	**"B.A. English – Professional Writing and Rhetoric" (beginning AY 2021 – 2022)**
Intro Course Requirement	None; advanced expository writing served as the *de facto* common course	Introduction to professional writing and rhetoric
Elective Distribution	15 credits total: • 12 credits across creative writing, technical writing, and media writing; • 3 credits of advanced history (junior level or above)	15 credits total • 12 credits across courses in TPC (e.g., technical writing, science writing, grant writing, professional editing), creative writing, and rhetoric and composition (e.g., teaching writing, rhetorical theory); • 3 credits of digital composing (e.g., web design, audio production)
Literature Requirements	15 credits total: • 3 credits of introduction to literary studies; • 3 credits of major authors (seminar); • 9 credits of junior-level literature electives	12 credits total: • Any literature electives at the 300- or 400-level

Table 1. Comparison of credit distribution between Misericordia's former "writing" track and the relaunched "professional writing and rhetoric" track (cont.)

Internship Requirements	6 credits (generally across two semesters)	6 credits (generally across two semesters)
Capstone Requirements	None	3 credits: • Advanced theory course (literary theory or rhetorical theory); or • Professional writing thesis; or • Creative writing thesis

Other than the internship requirement, the revisions outlined above are fairly sweeping. Without getting into too much institutional history, after hired, I identified clearly that few resources (and no full-time faculty) were dedicated to working in the track other than to teach material that was primarily creative-writing oriented. Even the one common required course—Advanced Expository Writing—had historically been taught by an affiliated staff member primarily as a long-form journalism course. Literature requirements were more structured and focused than the writing requirements ever were, a side effect of the program being staffed by accomplished literary scholars. The changes the department implemented reversed these trends. Literature requirements were reduced from 15 to 12 credits and opened to any literature course (i.e., students are no longer required to take the "major sequence"). The history requirements were replaced with "digital composing," an area largely within the purview of our nearby Communications Department. The common course replaced Advanced Expository Writing for a straightforward Intro to PWR course, covering rhetorical principles, audience analysis, style, and project management. These changes are reflected in the marketing language around the program, which emphasized that "PWR" is the *professionalized wing* of the English department. It is a bid—to be blunt—that students will be more likely to join the English department if a clear pathway to a profession exists built into the department.

To that end, the marketing language around the newly-minted

"PWR" program would come to emphasize internship experiences, "practical" experiences, service projects, and portfolio building. "Hands-on" became the mantra. Yet, launching the program in the middle of COVID tested that mantra. As the program was set to launch, my next step as administrator—seeking community partnerships, bringing stakeholders to campus and going out into the community to meet them at their worksites—became impossible. Thus, figuring out a way to address the immediate concerns of pandemic-era learning while teaching real-world exposure to TPC problems would prove the first of several problems that called on "magical thinking." I was called to react to the sudden change in the administrative circumstances and find opportunity within that change. I was called to determine what could be controlled in an uncontrollable moment and to leverage new-found opportunities. A pilot course, ENG337 – Professional Editing, was the suitable site for responding to that moment.

A "Magical" Vision for ENG337—Professional Editing

Editing's role in technical and professional communication (TPC) programs is well-established. Lisa Melonçon (2021) has already identified the editing course as the most popular course among undergraduate TPC programs. Moreover, she has previously identified the large swath of programs that *require* such a course, most commonly characterized as a Technical Editing or, more simply, Editing course, and most commonly at the junior or senior level within a program's curriculum (2019; pp. 174-175). As such, exposure to editing practices—whether technologically- or theoretically-grounded in classroom delivery—is almost a given in TPC curricula. Further, much has been written about the alignment between editing pedagogy and professional editing practices (e.g., Dayton, 1999; Duffy, 1995; Kreth & Bowen, 2017; Rude, 1996; Rude & Smith, 1992; Thomas, 2009). Early field surveys emphasized technology's role—both digital tools and platforms—in professional editing work, with Carolyn Rude and Elizabeth Smith (1992) finding that a majority of technical editors were performing tasks—notably many of the tasks surrounding the production of visuals—on computers. Yet the turn away from the purely technical, window-pane-theory-of-language approaches to TPC fields since that era is also pronounced. For one, Shelley Thomas (2009) indicated such a turn precisely because their research questions are rooted in an *ethos* that attempts to look beyond "grammatical correctness" alone. Another editor's survey by Melina Kreth and Elizabeth Bowen (2017) followed in these footsteps but with much more reach, noting not only the range of materials

technical editors are meant to work in but also the importance of workplace skills that range from collaborative and committee work to project management, HTML mark-up, manuscript solicitation, teaching, and graphic design (pp. 242-245). More recently, Suzan Flanagan and Michael Albers's (2019) edited collection *Editing in the Modern Classroom* contained Flanagan's and Melonçon's state-of-the-field essays and ventured into a range of modes for approaching editing pedagogy, be it affective, feminist, international, and so on, signaling a sea-change in editing pedagogy (and TPC writ-large) over the past decade-and-a-half.

Flanagan's (2019) takeaway after surveying the field has provided, perhaps, the most straightforward assessment of what an undergraduate editing course in TPC—particularly those at liberal arts institutions—could strive for:

> While it's not feasible to train students to know and do everything, we can prepare them to meet many industry needs. Technical editing students should be taught to approach editing work as a complex communication problem that requires strategic assessment; ethical, audience-centered solutions; and targeted attention to detail. In other words, students should analyze the writing situation and triage the text before fixating on grammar clean-up. Educators should stretch students' perceptions of technical editing and help students embrace a problem-solving mindset. In addition, educators should socialize students for collaborative work that demands strong interpersonal skills, technical aptitude, and flexibility. Students should be exposed to—or at least aware of—current editing tools and technologies, information architectures, and project management styles. (p. 40)

Flanagan represents a robust ideal for the range of material covered in an editing class, which is a heavy lift in the best circumstances. In a brand-new program, facing a room of students who, for the most part, have never encountered rhetorical principles before, how much time would need to be spent unpacking "analyze the writing situation" alone? However, even within the context of this specific course, in this specific semester, under these specific pandemic conditions, Flanagan provided a set of potentially-attainable end-goals. Given the population of the class (14 undergraduates including first-year students, final-semester seniors, full-time undergraduates, and part-time, non-traditional students, seeking degrees in English, Communications, Psychology, History, and Natural Sciences), it would be necessary to

build a common, foundational language. This would be easy enough; Misericordia remained in person—albeit in socially-distanced classrooms with far fewer desks—for a majority of its courses through most of the pandemic[2]. The far more difficult pieces would be things like soliciting revision, managing project workflow, and navigating collaboration, skills that Flanagan (2019) and, more precisely and pointedly, Kreth and Bowen (2017) cited as ideal for preparing students for professional editing's reality. And even more pointedly, it's the engagement pieces—collaborating with "live" authors, working with stakeholders in the editing process, and managing "live" projects, to use Lisa Melonçon's (2019) terminology—that rise to the top as most "valuable" in editing pedagogy today and thus become a controlling variable of any "magical thinking" around what such a course could become.

Plenty of sharp, insightful, and useful commentary exist—especially in this venue—about the changes brought to programmatic life and work as a result of the COVID pandemic (e.g., Henning & Bemer, 2021; Nagelhout & Tillery, 2021; Sides, 2021). Nora Rivera and Laura Gonzales (2021) provided one of the more generalizable approaches to come out of the field in COVID. By "generalizable" here I don't necessarily mean in the traditional sense of "generalizable data" or "generalizable findings," but, instead, an approach to the questions of pandemic policy that is widely applicable. Specifically, Rivera and Gonzales promoted a "pedagogy of love" largely informed by J. Estrella Torrez's work, intent on, among other things, "building community with students beyond the instructor/student binary" (p. 60). Following the recent turn of social justice work in TPC, Rivera and Gonzales have looked to non-profit partnerships for students to model ethical citizenship from their position as student technical communicators (see also Kramer-Simpson & Simpson, 2018). Such purposeful modeling of the conditions of technical communication work—ideally the type of community-centric modeling Rivera and Gonzalez explored above—is a widely-accepted ideal in the field today and echoes my own values as a curriculum designer. However, to echo Teresa Henning and Amanda Bemer (2021) in that same issue, the pressures brought to higher education by the pandemic and the attending austerity—particularly acute at small institutions—create an environment that demands strategies for survival, first and foremost (see also Denise Tillery and

[2] There's not enough space in this venue to write about the spatial dynamics of a distanced classroom in higher education, particularly in a discipline that values animated collaboration and the movement of ideas and items among various experts. Suffice it to say that much material that would initially be more hands-on, in that first pandemic year, unfortunately reverted back to lecture-based delivery and solitary work with individual documents.

Ed Nagelhout, 2015) on the economic trends that shape TPC in higher education, largely a response to the "do more with less" ethos championed by many administrators in the field in recent decades.

In brief, ENG337 – Professional Editing grew from this crucible: the demand to (re)create a marketable program to increase enrollment, implementation of that program at the height of the COVID-19 pandemic, financial and social austerity measures placed on me and my students during the pandemic, increased isolation, and desire to make this program as public- and client-facing as possible, in line with the major selling points of the program as a whole. And, though ample problem-solving models exist to address these multiple forces, the concept of "magical thinking" can be read as promoting a principle of balance, a balance that, in the face of a suddenly-shifting pedagogical and administrative landscape, helpfully puts administrative and programmatic truisms in the decision-making foreground.

Dubinsky's (2010) programmatic narrative from Virginia Tech discussed approaches of balance via the principles of "phronesis" and "praxis" (p. 277), a shorthand for "theory and practice," the "epistemic and [the] instrumental," or, following Dewey now, "open mindedness and responsibility." Dubinsky has forwarded what is now a truism: such principles ground the field, and the balance between the two has helped broker many a programmatic struggle (which, I'm willing to wager, holds true in this special issue, too). Yet Dubinsky seemed to separate the phronesis-praxis balancing act from his understanding of "magical thinking." For him, the "magical" sticks with Didion, in the realm of affective response to change, yet, as his narrative suggests and as my own experiences certify, part of the "magic" is, in fact, keeping this balance and other such principles in view as we react. At times, such magic is merely implicit, such as in discussions of buying out course loads for program development, appealing to the University mission and strategic plan to gain allies, and establishing credibility and sustainability through further growth and hiring. "Magical thinking," at its core, is a "rhetorical process," crafting arguments through "imagination, collaboration, and deliberation" (p. 292). It's about building bridges between contingents in a community based on common ground and, more importantly, "common practices" (p. 293). However, one critique of Dubinsky's approach to "magical thinking" is, quite reasonably, that he loses the element of the velocity of change that undergirds the idea at the opening of his essay. The element of the "unexpected," by the close of his programmatic story, is almost completely forgotten (p. 277). So, what, then, does dealing with the unexpectedness of pandemic-era pedagogy and curriculum development

look like?

As administrators, instructors, and designers, it is often difficult for us to imagine the shape a course can take—particularly courses under the banner of hands-on, experiential, and/or live learning until we meet both our students and our stakeholders where they are. Such unknowns are only heightened by the newness of programs (or programmatic revisions) or courses. They are heightened, still, as we encounter unknowns like pandemic landscapes. Professional Editing was presented as the debut of the new, hands-on PWR curriculum. It was marketed broadly across departments and colleges with my own digital flyer (see Appendix A). Such broad marketing and the language of the course flyer—emphasizing "contexts" of editing practice and the broad applicability of the "skills" for all majors—belies some of the uncertainty around the course's shape. Moreover, as institutional austerity measures and the reality of the COVID pandemic strained resources on campus (e.g., the office of service learning, internship coordinators), and my relative unfamiliarity with the region became exacerbated by those realities (i.e., in only my second year in the area, I was largely unaware of outreach opportunities in the community around campus and had only started sourcing contacts when COVID closed the campus), it became necessary to narrow down a set of priorities quickly. That is, the "magical" process returned to that balance of theory of praxis; it returned to a process of determining how to hold onto what we value in the face of sudden and radical change.

What I witnessed at my institution heading into the first full "COVID year" likely reflects the experiences of most of this venue's readership. Students were largely isolated. Many returned to their homes in rural communities, and even those who didn't found themselves housebound due to great uncertainty about how to mitigate COVID transmission with any success. Many were taking some of their courses on-line or in a hybrid format, those in dorms had little access to areas off campus, and what social outlets remained had almost completely moved to digital platforms. Although Professional Editing would remain an in-person class, strict distancing policies and a lack of technology in a largely first-generation academic environment made agile, lively, mobile collaboration difficult. Connections with industry were non-existent, not only because of my newness to the region, but because, frankly, few brick-and-mortar industries exist around our campus. Spotty WiFi, regionally and in most of our students' homes, makes digital, synchronous collaboration a non-starter for many. What was demanded, then, was a structure that would allow students weeks of practice in basic skills of copyediting (e.g., formatting to style

guides, grammatical proficiency) and require, at most, asynchronous and distanced collaboration (e.g., email or Slack-based collaboration in small groups on discrete projects). By reflecting on my experience as a practicing editor in the not-too-distant past, I settled on a publishing-focused course design and set out to recruit "live clients" among the community I knew best: the University faculty.

I approached faculty as potential stakeholders not just for the success of this course or these specific students, but for the PWR track as a whole. In the years leading up to this course, a statistician colleague had been offering a student-run service for statistical consulting on faculty research. For some stakeholders at the university, the Professional Editing pilot could point to a more robust, end-to-end set of student-led services for faculty researchers, a huge lift at an institution where many teach overloads and commit to onerous service requirements on top of their base 4-4 teaching load. Initial emails to the faculty listserv emphasized this as an opportunity for faculty to gain another reader and editor eager to hone their skills. The response was quick. I received many open offers from my office neighbors (in History, Literature, Art History, and Philosophy) and from those whom I knew from other areas (Biology faculty I had new faculty orientation with, a chemist I knew socially). Faculty from College of Health Sciences and Education reached out *and* forwarded the message to their graduate students. A member of the Social Work program forwarded some chapters in progress; graduate physical therapy (DPT) students sent along dissertation chapters; a nursing faculty member sent me a textbook chapter she had due to publishers in a few weeks. Faculty were—to characterize their emails without quoting them—overwhelmingly excited by the project as I laid it out and the opportunity they had to collaborate with our students. Many faculty were thrilled that—as so often happens at tiny liberal arts colleges—they would have an opportunity to work with a former student from one of their classes again. Across the institution's colleges, faculty commended the kind of inventive thinking that allowed students hands-on work under COVID circumstances. All clients expressed, to some degree, relief that they could have help pushing projects over the finish line. In short, the faculty did recognize themselves as potential stakeholders here. The success of this course, and this project, in their eyes, would benefit the university as a whole.

Of course, recruiting clients and determining project workflow took several weeks. Publishing schedules for different clients, projects, and disciplines varied widely. Some clients began the semester promising one project to share and, by the time client projects began,

had two or more. Others over-promised, finding that projects were too far along or not far enough by the time student editors needed to begin their work. But this same spirit of "magical thinking" ultimately prevailed, as the quick changes among project availability and project types were able to reflect the "magical thinking" I employed around the course design and the uncertainty of entering the editing world: projects are often not hammered down until it's time to work on them.

The semester schedule similarly evolved over winter break and, in fact, into the early days of the spring semester. Initially, the course's shape depended on the number of clients and manuscripts I could source (i.e., a course with two students per live manuscript would look very different from the one-to-one match I was able to facilitate). At the start of the semester, the course was formulated as follows:

Table 2. Initial weekly scaffolding of professional editing. Includes summary of dedicated material, primary readings, and major assignments.

	Unit Summary	**Primary Texts**	**Primary Assignments**
Part 1 (weeks 1–6)	Introduction to hand editing and basic computer editing (e.g., track changes and commenting); introduction to Chicago Manual, MLA, and APA style and resources	Strunk and White's *Elements of Style*; *The Chicago Manual of Style*	Weekly hand-editing exercises; timed hand-editing quiz; large (35 pp.) manuscript edit
Part 2 (weeks 7–9)	Introduction to working with clients; basic client correspondence; troubleshooting "live" projects	*The Subversive Copyeditor* (Saller, 2009); Client texts	Opening client correspondence; first round of client edits
Part 3 (weeks 10–12)	Advanced client correspondence; further project troubleshooting; negotiating author, audience, and publisher needs	The Subversive Copyeditor; Client texts; Required style guides (Guest speakers from publishing houses joined us virtually these weeks)	All remaining client edits

Table 2. Initial weekly scaffolding of professional editing. Includes summary of dedicated material, primary readings, and major assignments. (cont.)

Part 4 (weeks 13–14)	Reflection on the editing process and the course	*The Subversive Copyeditor*	Statement of editing philosophy

The framework for Professional Editing was fairly intuitive. The first half of the semester was dedicated to copyediting drills, emphasizing academic style and troubleshooting with the Chicago Manual. Students scaled up with graded work, starting with standalone sentences, then unified paragraphs, then multi-paragraph structures up to, finally, the chapter manuscript. By semester mid-point, with clients and manuscripts settled, the class opened up. We moved beyond task-oriented skill-and-drill approach toward a more situated, project-based, and client-driven approach to editing.

Professional Editing Experiences, Data, and Reception(s)

I collected data on the course via two mechanisms. The first was the relatively standard course reflection paper that is a staple of my major-level writing courses. Students were prompted, through that standard assignment, to reflect on their progress throughout the course, their struggles and triumphs, and to contextualize that experience through a mix of assigned readings and their own reference points. The second collection mechanism was a slightly-more-formalized-than-normal client survey. Although I would normally collect feedback from any stakeholder, external collaborator, or course visitor via informal email, the circumstances of this particular course and the desire to replicate any successes in future semesters inspired me to formalize the data ever so slightly. To be abundantly clear: data was collected, initially, for personal use. However, what the data came to represent—including a movement toward collaborative, co-ownership of in-house editing by students and clients alike and a signal that successful stakeholder collaboration could be found despite the upending of the pedagogical environment—make sharing these data worthwhile. Thus, retroactive IRB was obtained covering the anonymized dissemination of this small data collection.

In all, 12 faculty and graduate students contributed 15 separate manuscripts. Fourteen went to students (one for each student enrolled in the course), and the fifteenth, a textbook chapter draft authored by one of our health sciences faculty, came to me to demonstrate

correspondence and project workflow for students. Correspondence and workflow were largely driven by Carol Fisher Saller's (2009) *The Subversive Copyeditor,* an incredibly readable trade book focused on the work of editing about client relationships and readership. Some of Saller's advice is relatively par for the course from a rhetorical standpoint. For example, she has explained how editors can help shape the purpose and audience for a text by noting, "Since documents have various purposes, it makes sense for editors to tailor them to suit different groups of readers" (p. 5); or, in giving advice for approaching new authors with initial edits:

> [Y]ou will save yourself much grief if right from the start you limit your expectations and work accordingly. Be conservative in your editing. Summon all the generosity you can, keeping in mind that this writer may have a take on his readers that you don't necessarily understand. (p. 39)

That spirit of generosity (and Saller's refrain throughout the book: "First, do no harm") became mantras for both the students and me in the final two months of the semester. I corresponded with clients sporadically, but thoroughly. I emphasized that they were not expected to do anything "extra" as a part of this student project. I assured them that students were learning not just how to edit but how to manage the editing process, which means practicing generosity in accounting for client schedules, deadlines, and disruptions. As I explained via email to all clients: "Editors love responsive and agreeable authors but also have to learn how to deal with overlooked emails and authors who need to step away from projects for a bit, too." Saller's (2009) book is, ultimately, a guide for breaking into editing as a profession (freelance or in-house), and by attempting to mimic a single-project cycle as closely as possible, with all the bumpiness it promised, students were called upon to build relationships with clients beyond acting as a simple functionary.

This kind of relationship building was vital to the large-scale client project that anchored the course. The assignment language listed three broad assessment criteria for the project:

- Student ability to plan for edits, based on in-class (informal) discussion of client requests, the style guide the student is working with, and publisher guidelines;
- The quality and effectiveness of student correspondence with the author assessed through a collection of correspondence; and
- The quality and effectiveness of final edits delivered by the student.

In other words, the scope of the project extended into areas of editing

practice that would require some "magical thinking" on behalf of the student editors, too. No two client deadlines were the same; nor was the content of any two projects. Some clients required edits before the official end of the semester; others hadn't yet found a publishing outlet. Because of this variation, students benefitted from the first of the three grading criteria, which called on them to develop an informal community of editors in the classroom. The work of community-building in the classroom and outside of it would provide students with both the context to understand sudden hiccups in the editing process and the resources to address those issues quickly, effectively, and generously. Students working with the same client (i.e., pairs of students working on subsequent chapters or two separate articles in progress) could go as far as to coordinate schedules not to overwhelm the client with edits. Students working in similar fields—notably the laboratory and health sciences, as these were most foreign to the students enrolled in the class—could troubleshoot discrete problems within those disciplinary conventions. They found resources to double-check Latinate spellings of scientific terminology, located and shared disciplinary style guide web resources, etc. This iterative and communal practice of troubleshooting discrete problems resonates with the "magical thinking" Dubinsky has promoted: responsiveness and adaptation in the face of sudden, tricky problems, leveraging local resources to identify new opportunities. Perhaps more importantly, it echoes the kind of relationship building among editors Saller (2009) has promoted, too.

The correspondence between students and clients echoed both this vision of "magical thinking" and the principles of Saller's (2009) "subversive copyeditor." By opening such correspondence with generosity and the preparation necessary to adapt to client demands, students overwhelmingly found that regular correspondence, even at the level of a quick email "checking in" with any small questions, would prompt clients to reciprocate that generosity in kind. Multiple students found themselves suddenly adjusting to new deadlines or a client "ghosting" them. Students responded generously at all turns, even as they returned to me concerned that these variables—reasonably all things out of their control—would negatively affect their grades. We devised strategies for working around such difficulties, whether that meant delivering edits in smaller chunks to clients on a rolling basis, crafting email subject lines that would accentuate the necessity for a response or, in one or two cases, determining when it would be necessary for me to step in and broker communication between a client and a student. In other words, despite setting out with a fairly straightfor-

ward vision for how client projects would unfold, circumstances called for quick changes and an emphasis on strange things (like email subject lines) to keep the course running smoothly. This, of course, had the unintended benefit of creating lively discussion on unexpected topics.

The final edits themselves ran a wide range in terms of effectiveness. Twelve of the fourteen students finished on or before the class deadline (two weeks before the end of the semester; time left to reflect in discussion and in writing on the course). Many students (9 of 14; approximately 64%) succeeded in the "subversive" maxim of "first, do no harm," and both met all deadlines and introduced no new errors to the manuscript. Of those nine, all were equally effective in keeping clear and regular correspondence with clients, too. Of course, these findings are not too broadly generalizable; they are the results of a single class section in a single semester and quite purposefully presented here as loose impressions gathered by a triangulation of assignment grades, email archives, and instructor comments on manuscripts. Instead, more generalizable data come from evidence of effectiveness (and ineffectiveness) gathered through student self-reflections and client surveys. There, we can move beyond the binary "this worked" and "this did not" and toward things more descriptive, complicated, and indicative of the full experience of this course under COVID.

Surveys were designed to be internal and instrumental. The first round of surveys was to provide students a "cover sheet" for their client projects (i.e., a sheet outlining client needs and expectations). The second round of surveys was to help me adjust the project for the next time the class is offered. Given the size and location of the program and Misericordia, elective courses generally run on three- or four-year cycles. In short, though the sample sizes here are modest, each data point is deep, descriptive, and designed to capture segments of the semester experience. Data are somewhat generalizable in that, at least conceptually, it can speak to the needs of internal stakeholders and how those needs can be better addressed. Perhaps the data can even point beyond moments where "magical thinking" is required—moments of sudden crisis—and help reaffirm some truisms of our field and our programs.

To give a sense of the range of projects and the range of concerns present among the client group, six clients (approximately 50%) representing seven projects provided information for cover sheets via the first-round survey. The type of writing was nearly evenly split between articles and book chapters (four articles and three book chapters), but the disciplines were vastly different. Two projects came from literature. One each then came from history, education, physical therapy, nursing,

and biology. Unfortunately, only four clients provided specific instructions to their student editors, ranging from the very basic (e.g., "feel free to ask any questions"), to more common requests (e.g., "publisher prefers American over British spellings"; "this is collaborative work so the style fluctuates"), and, in one case, more highly technical and specific (e.g., "When identifying the genus and species of a taxon, both are italicized, Genus is capitalized, whereas species is lower case. . . . Time periods referring to Early, Middle, Late (e.g.) Cretaceous are capitalized"). All six clients were in universal agreement about the type of edits they sought, too. All six listed "proofreading," "copy editing," and "line edits" as desired services.[3] Finally, all respondents indicated varying publication venues (a question asked so students could, if necessary, begin researching the appropriate style guides) which, again, demonstrated a range of stylistic considerations. One article was targeted for a cultural history journal which requires APA style. One chapter was under contract with a major publisher in the UK which has its own in-house style guide. Another text was a chapter for a doctoral capstone project, which follows yet another citation style. In short, not only were students being suddenly asked to work with unfamiliar material and unfamiliar writing conventions in a brand-new workflow, but only half were given any kind of guide. The degree of generosity required from these students to their clients, particularly from some of the students newer to the program, was immense. And, most importantly, the kind of "magical thinking" it would take to troubleshoot editorial and stylistic questions while maintaining a quality working relationship with (for many) a client they would never meet in person was almost insurmountable.

The end-of-project surveys reflected the varying results, both in terms of the produced edits and the relationships built between clients and student editors. Eight clients (73%) representing eleven projects (78%) responded to this survey. Although still not an incredibly generalizable sample size, the results are still useful both internally and, with some caveats, they can help guide the operations of similar courses. The small uptick in responses, for instance, is notable. My involvement in the project waned after it began, so it is unlikely that any external factor contributed to the increased response rate. What I gather isthat, overall, the faculty and grad student clients wanted to support the

[3] For clarity, this course differentiated among those items as follows: "proofreading" is limited to editing for grammar; "copy editing" includes issues of formatting, consistency, and citations; "line edits" extends to clarity and style at the syntactic level. These were the only options on the survey, and all respondents selected all three. Clients were, however, able to indicate specific kinds of content edits elsewhere, though all declined to do so.

continuation of this kind of service work, found it to be an exciting new feature of their academic lives, and thus took the time to offer constructive responses to their experiences. The feedback was generally positive, and, in fact, there was little correlation between student grades and individual client feedback.[4] On a 0–5 scale, in response to the question "With 0 being 'not at all' and 5 being 'completely,' how thoroughly did the student address the main editing tasks you had requested?" six of eight respondents responded with a score of 4 or 5; no respondent scored the thoroughness below a 2. In response to the question "How would you rate the quality of the edits and suggestions the student provided?" six clients again scored the quality at a 4 or 5 (four respondents went all the way to 5) and only one client scored the editing quality below a 3. These scores are all fairly strong given the rapidity with which students were placed in this unfamiliar territory. More surprising, however, is that the scores given to their correspondence and professionalism were even higher. In response to the question "How would you rate your editor's professionalism in correspondence?" all clients scored their editor at a 3 or higher, with five of eight scoring them a 5/5. In response to the question "How would you rate your editor's clarity (of their requests and their process) in correspondence?" seven of eight clients scored their editors at a 3 or higher with four scoring them a 5/5. The last scaled-response question, "How likely would you be to use a similar (free) service if not attached to a specific class?" yielded hopeful responses; six of eight respondents said they would be very likely (a score of 4 or 5/5) to do so.

On the raw data alone, 75%+ of the respondents appeared to have had an overall positive sense of the editing experience provided by the Professional Editing class. In less structured responses, the prevailing negative evaluation was attributed to timing and scheduling. One client expressed dissatisfaction with the way edits coincided with the Easter holiday; another cited limitations of their own time that made it difficult to course correct in the middle of revisions. One other client expressed minor dissatisfaction with some APA formatting. Otherwise, though, feedback was very positive. There were requests for student editors to remain available through the summer (two students, in fact, went on to continue working with their clients that summer) and beyond.[5] Most importantly, seeing the praise for student editor

[4] In all but one instance, survey results were sealed until final project grades were finalized. The one instance was due to an incomplete set of edits and that client declined to respond to the survey.

[5] I've since gone on to help a few students work as freelance editors while they remain students in the PWR program. As of this writing, plans are in motion to provide stu-

professionalism provided the most affirming feedback for the generous, "magical thinking" approach to training them as professional editors and writers: students "rocked" and were "professional and fulfilled everything [the client] had hoped for," they were "clear in [their] communications," and "thorough, patient, and professional."

The student self-reflections, however, proved most valuable. Framed as a final, graded, "statement of editing philosophy," students were invited to meditate on their approach to editing, and loosely recommended to make use of some metaphor while doing so and/or engage some assigned or unassigned text about editing. There was no directive to emphasize either the technical process of editing or the work of building client relationships; students could choose to balance their content according to what they felt most important about the work of editing. To give a sense of the range of student reception of the course activities:

- One editor's evolution required an abandonment of preconceived notions of good editing as "making the pages bleed." "Before this class," they wrote, "I strove to raise the documents I was editing to my personal standards. Instead of allowing my friends and family to let their individual styles shine, I forced their words to bend to my own writing method."
- Another editor emphasized that the class allowed them to embrace "simplicity." They wrote, "My goal is to go into a work as light-handed as possible, abiding by the rules when I can and using consistency as a guide for when I cannot. At the end of the day, I am working in the best interest of the client; helping them make a clear and engaging piece of literature is one surefire way to ensure that interest is met."
- A third student lifted directly from Saller's *Subversive Copy Editor* to explain how the triad of carefulness, transparency, and flexibility benefit not only the author and their editor but the reader, as well. To quote: "These three components are key to working well with an author, as they rely on a careful eye to look over their work, transparency so they may see what changes are made to their work, and flexibility in order to work with one another's desires/requirements. These three things provide the basis for a strong relationship that allows the editor to please both the author and the audience's needs."
- Finally, an editor described their approach as "assertively supportive": "As an editor, I know what the rules are, but as a writer myself, I

dents internship credits to work as peer editors for faculty and grad student researchers on a rolling basis.

> feel it is also important for me to not only respect but also preserve the creative dignity of an author....[T]here is a fine line between the familiarity and professionalism of the dynamic between a writer and their editor. Coming from the familiar side, I would be supportive and stand up for the author in the event that an edit is made that takes away from the author's style or one of the manuscript's messages. However, from the professional side, I would be assertive and try to understand why that editor suggested making that change."

Although this is just a sample of student responses, the few listed here are fairly representative of the two prevailing themes across student writing: their evolving sense of what "good" editing is and the trickiness of balancing "good editing" with maintaining generosity toward their clients. Whatever "magical thinking" they employed—the constant troubleshooting, the reminders from classmates to remain client-centered and reader-centered, the sudden shift in class time and in office hours to address incredibly local, niche problem we ran into today—worked. Even the editors whose clients ignored them, as was the case with the second bullet point above, found growth via this kind of thinking.

Local and Global Takeaways

Most importantly, these results presented above signal an overwhelming success in this experiment with "magical thinking," particularly having it transfer to the students' bags of professional tricks as they negotiated professional emails, workflows, timelines, and demands within strange, taxing, pandemic conditions. In short, it is difficult not to feel proud of my students and colleagues as I review student edits, surveys, and reflections. Yet, these materials constitute an admittedly imperfect time capsule. Only small asides to limitations on time and availability and a mention of "circumstances beyond academic control" offer any glimpse of the pandemic situation students found themselves in during this project. On the one hand, this may speak to the fraught discourse of "resilience" that seemed scattered around popular discourse at the height of the pandemic. There's little doubt that those of us in higher education—students, faculty, and staff alike—are reticent to speak about external forces, particularly how those external forces may negatively affect their work and their work experiences. Given the subject matter of technical and professional communication—which has always been about the interplay between texts and the forces that shape them—this is both ironic and disappointing.

On the other hand, however, I'm inclined to believe that the silence

on pandemic forces is also a sign that the "magical thinking" approach introduced in this course took hold, becoming a salient *ethos* in the room every Tuesday and Thursday afternoon as we sat and discussed interpersonal problems like how to deal with an author who wants to include elements of text beyond the norm of a given publication venue; editorial issues like whether "etc.," being itself an abbreviation of a phrase in a foreign language, would be italicized as an abbreviation; or discipline-specific issues like whether the word "president" would be capitalized in specific fields when referring to presidents of known organizations. All of these conversations were had in the context of what we say to the client or ask the client, knowing what we know of their schedule and their approach to queries thus far. Keeping that social dimension in view when troubleshooting curricular questions, programmatic problems, or discrete editing issues, is what I take to be the catalyst for "magical thinking."

The benefit of a "magical thinking" approach to course development and design might just be the unique fit the idea can have in professional and technical writing. In a field marked by responsiveness to clients, editors, users, and audiences—and in a field increasingly articulating how to respond equitably and justly to the same—what Didion set forth, Dubinsky sought to fit to his programmatic contexts, and I have tweaked ever-so-slightly here seems to propel an *ethos* of effective service and commitment *in principle* to the stakeholders and audiences we work for. In other words, these experiences and this reflective, retroactive data dig helped me reckon with what "magical thinking" means and, more importantly, recognize it as a feature of what we practice and teach. If academic writing is necessarily iterative, professional and technical writing—and the administration of the same—is magically responsive. In that sense, the little discussion of pandemic conditions through stakeholder and student reflections here is likely because of the sense that students were able to latch onto a distanced, asynchronous, flexible, and individualized project management style that emphasized generosity and relationship-building in a time of social fracturing. They built community and participated in the social life of writing at a time when community and social life was being suppressed. Part of the "magical thinking" required of the students in the course is not just accounting for the conditions of crisis in front of us but finding active ways to work against those conditions. In turn, this approach can help us tackle future global upheaval and even more local—perhaps even personal—crises to come.

What's been presented here is done with nods toward generalizability but with full awareness of the limitations of the same. The sample

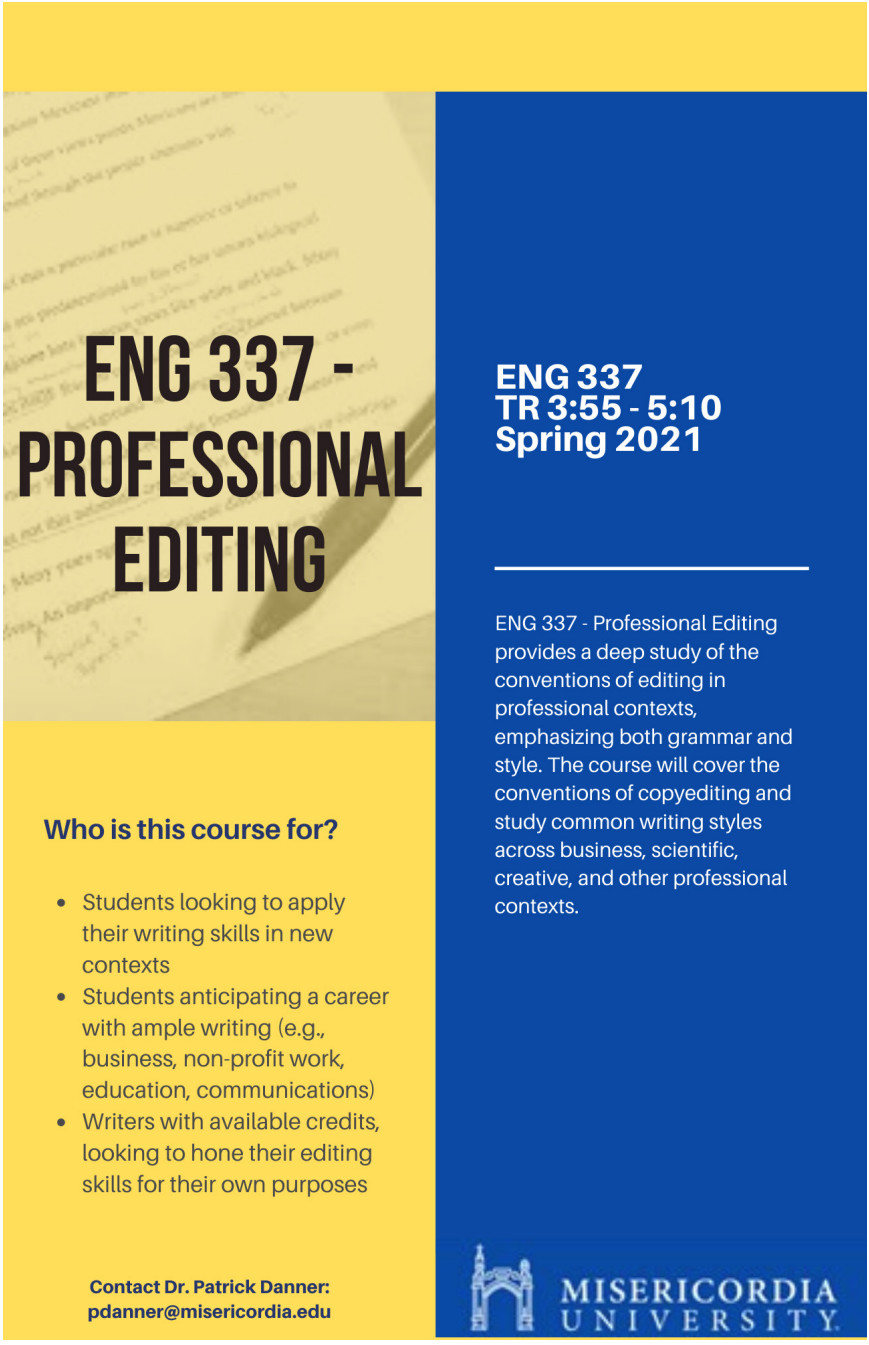
size—a handful of clients, most of a small group of students, a single section of a class—is the big barrier, for one. Replicability is likely another. We've adjusted to COVID as a field and a profession quite quickly, and I truly hope there isn't a need to respond to another large-scale, life-altering event anytime soon. But, unfortunately, it seems more and more likely that, at least on a small, local scale, someone at some institution will need to employ magical thinking as a response to some uncontrollable variable. Short-term pauses on teaching seem increasingly likely as global climate catastrophes regularly threaten and sometimes compromise the brick-and-mortar and digital infrastructures we use to teach and to collaborate. And longer-term shut-downs remain a distinct and terrifying possibility, too. The same climate catastrophes that knock out power could rise to the level of shuttering a campus semi-permanently. These climate realities and our unfortunate political realities point to the possibility of both small- and large-scale displacements or migrations of people. Political fracturing—particularly as the culture wars reach a fever pitch—threaten to shut down in-person learning at any moment.

Or, more immediately, at the time of this writing we're experiencing another uptick in COVID cases in my home region and nationally. Loosened mitigation measures have me and my colleagues on campus this summer and unmasked. Students are moving to quarantine once more and many are left without technical or social support. They are again barred from libraries, from course materials, and, in a lot of cases, cannot even contact their own faculty. What's generalizable here is that "magical thinking," as I present it, sees the common thread in each of these cases, real and hypothetical: "magical thinking" calls on us to imagine the circumstances facing those we serve and to work against the conditions of crisis. With ENG337, the stakeholders and students I sought to work with and for, it meant imagining what having enough resources could look like despite social fracturing. It meant declining to let the institution declare the crisis "handled." It meant studying the proverbial "available tools"—what I, my students, and their clients had on hand to complete work meaningfully—and troubleshooting any perceived gaps. It meant doing all of this because giving these students the experience of editing for a live client is too valuable not to "magically" make happen. And, even better, it proved to be an experience valuable beyond just a grade or just a course, but a valuable, professionalizing, life experience for these students.

Programmatic Perspectives is admittedly an odd place to bring up biological, climate, social, and political catastrophe. However, these things that once felt so foreign to our work are increasingly present in

how we approach our work. So, ultimately, this essay is just one humble comment about how we as administrators, instructors, and scholars can face the catastrophes that are ongoing and unfortunately likely to come. Though I believe this *ethos* of "magical thinking" for addressing gaps in student, faculty, and programmatic needs is an effective one, its biggest shortcoming is that it addresses the local by incorporating local fixes. In other words, "magical thinking" tends toward just-in-time fixes. Perhaps, then, another use for this heuristic can suit this moment, one that uses "magical thinking" as an analytical heuristic—a tool for understanding the local and global forces hindering student, stakeholder, and programmatic successes but not a heuristic for how to respond. As this conclusion lays bare, short term, local fixes can give us methods for responding to problems, but they don't address the roots of these problems.

Appendix A: ENG337 Flyer



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Connectivity, Expectations, and Expertise: Co-creation as a Model for Program Development

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Abstract. Working with industry stakeholders to design programs in technical, scientific, and professional communication can provoke discussions about the connectivity, expectations, and varying expertise(s) at work in the collaboration. Co-creation models for program development can mitigate these challenges by using program design and assessment practices that depend on stakeholder contributions throughout the curriculum. This article explores an example of the co-creation model at work in designing a project-based, studio-centered curriculum.
Keywords: Stakeholder Engagement, Program Design, Undergraduate Curricula, Academic-industry Collaboration, Methodology

How can technical communicators engage industry stakeholders within the development and implementation of a transdisciplinary program? To answer this question, we consider challenges faced and solutions acquired through the implementation of a co-creation model of program design between 75 industry partners and 27 faculty at a large polytechnic university. Created through a $20 million donation (Polikoff, 2018a) to develop a model of higher education that emphasizes "high-impact technology innovation that advances society" (Polikoff, 2018b, para. 3) the program, based in the university's honors college, teaches students to collabo-

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rate across disciplines and sectors to understand multiple perspectives to complex problems (Polikoff, 2018b). The program currently enrolls students in 18 major programs[1] , including English, communication, business, and engineering. Industry and nonprofit partners include stakeholders from the Boeing Company, General Electric, Caterpillar, the Association for Financial Professionals, the Capital Youth Empowerment Program, and Ithaka S+R.

Each semester, students in the program enroll in a project-based, studio course, where they work with students and faculty from multiple disciplines and industry partners from multiple sectors to research complex problems and prototype solutions. As examples, the program's teams have developed prototypes for measuring cognitive overload, created adaptive learning paths for underserved communities to access higher education, and designed robots to alleviate the risk of injury for factory workers. In addition to studio classes, students enroll in specialized coursework that teaches the skills that they need to collaborate and communicate across disciplines, manage projects, and prototype technologies. These courses include six credits of technical and professional communication coursework, as well as coursework in humanities, coding, and business management. The program has many stakeholders; we use the co-creation model to encourage their engagement in the program; to navigate expectations from students, faculty, and industry partners about the value of transdisciplinary education; and to recognize the different kinds of expertise at work within the program's projects and courses.

Industry-academic partnerships enrich student experience by providing mentorship opportunities and aiding transfer from classroom instruction to professional development. However, as scholarship in technical communication has noted, balancing these collaborations can be difficult. As Jennifer Bay, Richard Johnson-Sheehan, and Devon Cook (2018) acknowledged, maintaining connections with industry partners over time can be challenging (p. 190). Extending from this scholarship, we needed a model for program development to foreground the ideas of industry partners within the curriculum, with an eye toward encouraging their long-term engagement in the program. Another prescient concern from technical communication

[1] Current majors in the program are Cybersecurity Management and Analytics; Business Information Technology; Entrepreneurship, Innovation, & Technology Management; Human Resource Management; Management, Management Consulting and Analytics; Computer Engineering; Electrical Engineering; Industrial Systems Engineering; Communication; Multimedia Journalism; Public Relations; Computational Modeling and Data Analytics; Creative Technologies; Graphic Design; English Literature; Environmental Policy & Planning; Smart & Sustainable Cities; and Industrial Design.

scholarshipis the potential for unexamined focus on industry; in their commentary on dynamic program design, Kathleen Coffey, Angela Glotfelter, and Michele Simmons (2020) cautioned teachers and scholars to be "responsive" rather than "reactive" to external pressures, such as the demand for student workplace readiness (p. 139). Indeed, most of the program's media coverage focuses on its involvement with industry. For example, in an article appearing in *The Wall Street Journal*, the program was referenced as part of a "crusade to churn out more competent thinkers at a younger age" (Stoll, 2020). This article and other media coverage may lead to stakeholder perceptions that the program exists merely as a feeder program—a pipeline from education to employment with our industry partners. We needed our model of program development to address these varying expectations of workplace readiness as well.

We use the term "co-creation" to describe our method of program development because it implies that all stakeholders share responsibility for keeping the program running—now and in the future. Co-creation is a lofty goal that requires constant dialogue about what those responsibilities look like at any given moment. We anchor our co-creation model with procedures for stakeholder input and goals for program growth. As with other models of education for societal impact, including service learning (Bourelle, 2014), community-based participatory research (Brock Carlson, 2020), and the transformative paradigm for socially-just work (Phelps, 2020), co-creation facilitates knowledge production between researchers and practitioners when they work with various community stakeholders. We use the co-creation model to design a model for transdisciplinary education that enables sociotechnical innovation.

Transdisciplinary education and sociotechnical innovation are even loftier goals than co-creation. For us, "transdisciplinary" means that students are prepared to move throughout different disciplinary schools of thought to solve a given problem. Students majoring in liberal arts and human sciences take coursework in prototyping and developing business plans, whereas students majoring in engineering and business take coursework in environmental sustainability and societal inequalities. We use the term "transdisciplinary" in alignment with feedback from industry partners who have criticized the disciplinary boundaries of the contemporary university. One program stakeholder noted in *The Wall Street Journal* that colleges are not "teaching how to think outside the cubicle or beyond the screen in front of them" (Stoll, 2020). Dividing students into major-based skillsets impacts their ability to lead programs and projects, creating a "discovery gap" that

employers have to mitigate. Without the ability to think across sectors and disciplines, individuals are unable achieve sociotechnical innovation.

Sociotechnical innovation refers to solutions or prototypes that involve both societal and technical interventions to solve wicked problems ("wicked problems" originally used in Rittel & Webber, 1973). For instance, the student team that designed robotic elements to alleviate the risk of repetitive motion injuries for factory workers includes updated training and workplace policies alongside the technical fix. Students learn that sociotechnical innovation is an approach that "[considers] financial viability and technological feasibility, ecological and socioeconomic sustainability, and inclusive human capital development," according to one of the program's industry partners (Association for Financial Professionals, 2021). The program's industry partners and faculty mentors help students navigate these conflicting demands of industry-motivated outcome areas, emphasis on technological innovation, and focus on societal impact.

In this article, we detail the development and assessment of our co-creation model with 3 years of programmatic data, including internship placement data and student experiences. As students and industry partners collaborate to determine sociotechnical solutions to complex problems, faculty provide concurrent instruction in project management, technical know-how, professional writing, and presentation and interface design. Students transfer these skills directly into projects during their first year and further develop these skills within the program's studio and capstone courses. Working with students who can communicate and collaborate across disciplines, industry stakeholders envision new opportunities for recruitment and leadership within their companies. By integrating faculty, students, and industry partners within the co-creation model, this article details how technical communicators can synthesize stakeholder connectivity, expectations, and expertise to design and sustain transdisciplinary programs.

Literature Review

This article's development of a co-creation model for engagement of program stakeholders aligns with scholarship in technical communication, particularly research in project-based learning and industry-academic partnerships. This literature review connects our project with research on involving stakeholders within student course projects and programmatic partnerships. We then touch on some of the industry-motivated and institutional forces our program is in conversation with,

like point-of-need learning (PNL) and micro-credentialling solutions to advance transdisciplinary education. As we navigate these stakeholder-given specifications for the program, we find ourselves drawing on this scholarship to shape the co-creation model to better integrate stakeholders within the program and its curriculum.

Project-based learning that asks students to work in groups to complete written or multimodal deliverables is common within technical communication pedagogy. As the Technical and Professional Communication Community of Practice (n.d.) noted, common deliverables taught within technical communication include resumes, reports, proposals, information design projects, instructions, and other research projects. Project-based curricula provide a focus for these genres and aid student learning about workplace writing, project management, and tools for successful collaboration. However, some scholars have called attention to the need for innovation in technical communication coursework. For example, Bay et al. (2018) asserted that "students in technical communication service courses need to be taught how to think like entrepreneurs, which means mastering creative processes that propel innovation in the entrepreneurial workplace" (p. 172). As the authors noted, engaging in design thinking practices helps technical communication grow beyond traditional, transactional genres of writing. Entrepreneurial education emphasizes the "invented" genre, contrasted to "standard business genres" (p. 173). These "standard" genres also may cause tension between perceptions of technical communication pedagogy, like teaching students to write clearly, and goals of technical communication as a field. As Laura Gonzales, Kendall Leon, and Ann Shivers-McNair (2020) noted, technical communication pedagogy has "a long way to go to adequately support students' diverse communicative practices, cultural and racial experiences and expertise, and embodied histories" (p. 68). Accordingly, when designing curricula, technical communicators need to balance stakeholder specifications for coursework alongside the field's pursuit of social change.

In addition to genre innovation, industry partnerships can add to program visibility both inside and outside the institution. Lora Arduser (2018) examined how technical communication scholarship has been concerned with disciplinary power and legitimacy in relation to industry (p. 15). The more connections that a program is able to make, the more visible it is within the community. In context, visibility can lead to additional partnerships with industry and additional sociotechnical problems for students to consider. As Steven Fraiberg (2021) wrote in his introduction to a special issue on innovation and entrepreneurship communication in a global context, "entrepreneurial clusters"

intersectwith higher education as universities collaborate with communities and industry partners at both local and global levels (p. 176). Given technical communication's facility with networked systems, scholars are "solidly positioned" to explore how entrepreneurial collaboratives are situated within rhetorical practices (p. 177). Presented in this way, industry partnerships provide contributions beyond student experience and the opportunity for programmatic improvement.

Alongside other technical communication scholars who caution against industry involvement as a quick solution to a program's need for innovative curricula, or workplace preparedness, we want to briefly note some concerns with industry collaboration. In 2006, Emily Thrush and Linda Hooper asked questions made pertinent given the emphasis on efficiency in higher education:

Have we kept up with trends and needs in the industry for which we are preparing our students? How do we keep our own skills up-to-date, keep our courses relevant to our students' needs, and prepare professionals with the flexibility required by the rapidly changing world of professional writing? (p. 308)

For Thrush and Hooper (2006), the answers resided in team-teaching opportunities at the course level and frequent collaboration between students and industry partners. The move is a common one though; given student feedback about working with industry partners, team teaching with industry partners does not automatically bring innovation to the curriculum.

As well, when collaborating with industry partners, partners may be tempted to think about academia and industry as opposites: one based in theory and one in practice. Ann Marie Francis (2018) examined this perceived divide between classroom projects and industry writing based on studies in technical communication. Scholars articulate the need to cross over the perceived academic-industry divide, often for programmatic benefit. As Chris Eisenhart and Karen Gulbrandsen (2020) commented, creating curricula that connect theory and practice in alignment with expectations from students and industry is a trend in the field, resulting in more flexible options for degree-holders (p. 82) The addition of industry partnership, however, does not automatically yield more engaging, transferable educational experiences. Elisabeth Kramer-Simpson (2016) explored models of industry mentorship of student interns, finding that most industry mentors "…rarely build in supports in the design of the project. Rather, they at-the-moment assess student understanding through frequent

face-to-face meetings and provide feedback and guidance..." (p. 83). In context, students often express confusion that industry partners do not have all the answers, nor can those industry partners express definitively what the project team should do to get a good grade on the deliverable. Industry partners provide students with one perspective toward sociotechnical innovation. Just as students are encouraged to find additional stakeholders to provide perspectives on prototypes, technical communicators should rely on additional stakeholders when building programs.

In keeping with our program's emphasis on transdisciplinary education and sociotechnical innovation, we collaborate with our own stakeholder to envision what workplaces and work practices might look like in the future and which educational models might best facilitate the future of work. Conceptualizing the future of work in this way also has led us to incorporate perspectives on PNL and micro-credentialling, both practices of building lifelong learning into the workplace. These practices have allowed us to design a transdisciplinary curriculum that insists that all students learn the fundamentals of technical communication, graphic design, programming languages, and program management. In the following section, we elaborate on the methods we use to integrate these transdisciplinary pathways within the program's design.

Method

In this section, we discuss using the co-creation model as a methodology for program design and assessment. We used multiple methods to design, deploy, and assess this model of program design: focus groups of different stakeholders, questionnaires of students at different points during the program, semi-structured group discussions of students and faculty, and observations from participating faculty and industry partners on the model's effectiveness. We also include relevant program deliverables in our analysis, including student projects, internship and other placement data, and other curriculum information. We choose these multiple methods because, at any given point, the program includes approximately 250 stakeholders; we require feasible and sustainable means of collecting and analyzing perspectives from all participants[2].

[2] From 2018 to 2021, programmatic data were collected by the university's Center for Higher Education Innovation. These data were considered to be program assessment and were exempted from further review by the university's institutional review board.

Technical Communication and Program Assessment Methods

The methods we employ in this study are not unknown within technical communication scholarship. Focus groups, surveys or questionnaires, and collecting program deliverables are common ways of including voices of stakeholders within programs as well as assessing program outcomes. For example, in Chris Dayley's (2021) article on student-informed practices for recruiting diverse students, the author encouraged the use of advisory groups and surveys, among other communication methods (p. 33). Meanwhile, Henry Covey, Jordana Bowen, and Sarah Read (2021) noted that "focus groups, surveys, and interviews with individuals" are "information gathering methodologies for UX" (p. 125). In Scott J. Kowalewski and Bill Williamson's 2016 program showcase, the authors included "focus groups, questionnaires, exit interviews, and in-class reflections" to include student voices in programmatic change (p. 114). Moreover, Sweta Baniya, Ashley Brein, and Kylie Call (2021) analyzed student reflection videos to determine student experience and perceptions of growth (p. 34). We use these methods to codify the shared responsibility of our many stakeholders in creating our program. As aforementioned, co-creation is a lofty goal and a model for program design that is difficult to enact. Using focus groups, questionnaires, and semi-structured discussions to create pathways for the inclusion of stakeholder perspectives is one way to show stakeholders that their input is necessary for the program's continued existence.

The Data Collection Cycle

We built data collection into the program's yearly operation through events for students, faculty, and industry partners. Industry-partner focus groups take place through orientation and student exposition days, and faculty/student semi-structured group discussions are held at the conclusion of each academic year. Student questionnaires are distributed shortly after exposition days, giving us six data collection points per year. We describe these data-collection methods and choice of student deliverables for assessment below.

Industry partner focus groups. Perspectives from industry partners are imbricated within the program through focus groups deployed at three points each academic year: the industry partner orientation, an exposition day (Expo) at the end of the fall semester, and a final Expo at the end of the spring semester/academic year. During each of these all-day events, industry partners, in conversation with faculty, categorize sociotechnical problems that they foresee in their organizations into broader outcome areas. These outcome areas provide organization for students and thematic focus for the program in

the following year. As well, industry partners also provide feedback on PNL modules with which students should engage to learn more about the outcome areas. (Table 1 shows how outcome areas help group sociotechnical problems.)

Table 1. How industry-provided outcome areas help group sociotechnical problems and structure means of proposing projects

Outcome Area	Sociotechnical Problems within Outcome Area
Innovation and Society	Adapting educational technologies for prisons; providing energy to power internet access and educational technology for energy-insecure households in the county
Product/Platform Capabilities	Proving inclusive clothing size options through supply-chain management and interface design
Advanced Manufacturing	Reducing physical stressors on workers through robotics and augmented reality; preparing lunar surface for excavation and habitation

Faculty/Student semi-structured group discussions. Once industry partners choose outcome areas, faculty and students participate in an open forum to co-create ideas about which sociotechnical problems teams might address in the coming academic year. To co-create ideas, students learn about outcome areas and produce multimodal project pitches that include problem space, solution concept, and potential industry partner. Students vote on their preferred projects and teams are formed for the coming year. (Table 2 shows how outcome areas define sociotechnical problems, which, in turn, lead to transdisciplinary project teams.)

To assess programmatic outcomes of transdisciplinary education and sociotechnical innovation, we focus on collecting student deliverables related to project-development milestones. Project-development milestones help us cohere to the standard 15-week academic semester while still showing students that industry-motivated projects often take years to complete. Project-development milestones, borrowed from the NASA Program/Project Life Cycle (National Aeronautics and Space Administration, 2019), provide timely touchpoints for students during the semester while still moving the project forward into the next semester and academic year. Deliverables associated with project-development milestones include multimodal presentations, stakeholder interviews or site visits, risk assessments, business plans, and prototypes. Although students deliver project-development

milestones each year, expectations for the items associated with each milestone increase as the students move through the program.

Table 2. Exploring how outcome areas define sociotechnical problems and lead to transdisciplinary project teams

Outcome Area	Sociotechnical Problems within Outcome Area	Distribution of Academic Majors on Sample Teams
Innovation and Society	Adapting educational technologies for prisons	Communication, Industrial Design, Computational Modeling and Data Analytics, Management, Business Information Technology
Product/Platform Capabilities	Proving inclusive clothing size options through supply-chain management and interface design	Business Information Technology, Industrial Design, Industrial and Systems Engineering
Advanced Manufacturing	Reducing physical stressors on workers through robotics and augmented reality	Architecture, Electrical Engineering, Computational Modeling and Data Analytics, Industrial and Systems Engineering, Business Information Technology

Questionnaires. In addition to motivating student-produced deliverables, project-development milestones also provide an inroad for assessing student and industry partner perceptions of the program, co-creation model, and collaboration efforts for all program stakeholders. At the conclusion of each milestone, students and industry partners complete separate questionnaires about the program, projects, and student experience. These results help us assess current projects and industry perceptions of student learning.

Student questionnaires focus on experience working on the project, experience working in groups, transdisciplinary learning (or what skills outside their discipline they have employed in the project), and experience with specific industry partners. Industry-partner questionnaires assess how effective project teams are at analyzing the sociotechnical problem space, proposing an innovative and socially impactful solution, employing design concepts, describing risks, issues, and mitigation plans, articulating a business plan, and formulating

realistic project outcomes and a completion plan. With team deliverables, questionnaires provide student and industry-partner perspectives on the capacity of the co-creation model to address collaborative sociotechnical innovation.

Results

Going into its fourth year, our co-creation model has resulted in programmatic growth. We measure programmatic growth by the number of industry partners and inclusion of new major programs. In three years, the program has gone from 3 to 75 industry partners ("Calhoun Discovery Program," 2018). Additionally, the industrial sectors from which these partners hail have become more diverse. Three years ago, industry partners were mostly engineers, but with the recruitment of new partners from nonprofit, business, and governmental sectors, professors of practice can now provide expertise in business plans and marketing, data analytics and machine learning, and educational technology for workforce development, among other areas. The ideas that these industry partners contribute to programmatic discussions have resulted in additional outcome areas for the program and new opportunities for students. As well, when industry partners from multiple companies and sectors serve as mentors on a team, all members are better able to understand how disciplinary silos have constrained the workforce and how transdisciplinary project teams might transform work environments.

The program also draws students from a larger number of major programs, from 12 majors in 2019 to 18 majors going into the 2022–2023 academic year.

The work of forming course substitution agreements with admissions specialists and advisors is a separate logistical feat, but the increase stands as evidence of other academic programs' support of the learning experience offered by our program. Despite multiple course substitutions each year for students to take project-based courses through our program instead of through their home departments, only one academic program has objected to the loss of student credit hours. As an additional sign of support from affiliate academic programs, many admissions specialists present the program to students as an alternative opportunity to traditional coursework, leading to increased numbers of students expressing interest in the program and

completing admissions interviews[3].

Transdisciplinary Education and Sociotechnical Innovation

We examine transdisciplinary education and sociotechnical innovation facilitated by the co-creation model by analyzing how students have adjusted to the educational experience offered by the program, parsing student internship data and collecting student deliverables related to project-development milestones. Results from student-experience data and internship-placement numbers speak well for the value of the transdisciplinary learning experience. Deliverables from project-development milestones suggest that student teams understand the value of sociotechnical innovation based on the increasing numbers of high-fidelity prototypes produced. However, industry partner and faculty observations of prototypes have noted the need for increased innovation in student projects.

Student questionnaires taken from each cohort indicate that students are learning skills from outside their home majors in the program, which bodes well for our programmatic focus on transdisciplinary education. Although numerical satisfaction scores remain consistent across cohorts, with students rating their experience in the program as 3.8/5 on average, qualitative data about student experience show increased transdisciplinary skills learned. (Table 3 shows how students in different cohorts responded to this prompt.) Although students in the 2020 cohort report gaining research, interviewing, and presentation skills, students in the 2021 cohort report gaining more specific transdisciplinary skills like coding, using Arduinos, learning new software, and writing business plans. The shift may indicate efficacy of the co-creation model at promoting transdisciplinary capabilities in students.

Internship-placement data, in conjunction with observations of student professional development, also aid our claim that the transdisciplinary education promoted by the program impacts student success. In summer 2021, 76% (28/37 second-year students) and 38% (14/37 first-year students) received summer[4] internships or fellowships at companies including Deloitte, Noblis, Verizon, Aurora Flight Sciences, Spectrum, Intel, the Environmental Protection Agency, the Naval Research Laboratory, Dell, and General Electric. Although we will not have data on our graduating students until 2023, data already report a higher percentage of second-year students in internships than the

[3] As the program is still in its pilot, student enrollment is capped, so we do not use enrollment data to examine programmatic growth.

[4] Though we encourage students to seek out paid internships, students in the program receive a $2500 stipend each year to use toward experiential learning, including room and board costs during summer internships.

Table 3. Differences between skills reportedly learned in different cohorts may show evidence of transdisciplinary thinking (Source: Optional question on student-experience questionnaire provided to each cohort at the end of the first year in the program)

First-year Students in 2020 Cohort	First-year Students in 2021 Cohort
In this phase I really learned the importance of scale.	I never knew how to code or what that looked like which I learned.
How to access risks a solution may have.	I learned how to use an Arduino and write a business plan
How to develop a significant project in the private sector	Fusion 360 and CAD in general.
Learning how to research effectively, improve my quality of work	I learned a lot from my peers on designing through CAD as well as animations.
I had to do a lot of research so I could understand the subject matter of my project, but I really liked in the interviews learning about the different policies and obstacles our industry partners faced.	collaboration, making a pitch, business model, prototyping
I improved my recorded presentation skills, I learned a lot about supply chains, and I learned how to work with new types of people. I also learned more about the system viewpoints.	I learned more about technical skills that I had never used before.
I learned about industry 3D printers, about the business aspect of contracts and regulations industry has to follow, and how to get a lot of work done in a little bit of time	I learned a lot about being a teammate instead of a leader. I had to actually compromise and people didn't blindly listen to me. I learned a lot more about effective design when it came to our presentation and expo materials, and I feel I honestly gained way more than my traditional track peers, because I feel I didn't learn or gain near as much from my other classes combined as I did in studio.

national average of graduating seniors (60%, according to the National Association of Colleges and Employers, 2017). Combined with observations of student professional development from both faculty and industry partners, the program seems to provide students with the experiences that they need to be competitive in obtaining internships. Students report, for example, that when interviewers see transdisciplinary, project-based learning on their resumes, the remainder of the interview usually focuses on those projects instead of other coursework-based learning experiences. As another example, one of the authors participated in internship interviews with students from the program and compared their answers to those of their peers outside the program. He found that students who participate in the program's project-based curriculum are able to provide more details in their responses as well as more accurately assess their own interview performance. These results suggest that the program has been effective at designing transdisciplinary learning experiences that aid student internship placement.

Results from student project-milestone deliverables suggest that the prototypes created by student teams have become more advanced, indicating that the program is succeeding at its second aim of sociotechnical innovation. For example, by the end of the first-year studio course, students are expected to create a low-fidelity prototype. Low-fidelity prototypes, according to Usability.gov (2022), are "paper-based and do not allow user interactions. They range from a series of hand-drawn mock-ups to printouts" (para. 7). High-fidelity prototypes, in contrast, deliver a more realistic user experience (para. 8), often through computer visualizations or a robotics kit. Although in the first year of the program, most student teams produced low-fidelity prototypes, the norm is now for students to create multiple, high-fidelity prototypes despite being in their first year. In fall 2021, a first-year team completed research on autonomous systems in support of NASA's Artemis III mission. The deliverables included a technical prototype of a robotic drill and a visual of the end product in computer-aided design software (CAD). Across student projects, other project-development milestones like risk matrices and business plans also have become more advanced, perhaps due to additional mentorship from industry partners specializing in those areas. The production of more advanced project-development milestones indicates that the program may be encouraging sociotechnical innovation.

Industry-partner feedback, however, suggests that the program has room to achieve more sociotechnical innovation. Industry partners regularly question how a particular solution is innovative or technolog-

ically advanced. For example, before project-development milestone presentations, student teams prepare answers for common questions like "What is the enabling technology?" and "What is the innovation?" Feedback from industry-partner questionnaires also picks apart common student assumptions. Many business plans submitted in the first- and second-year studio courses assume that prototypes commonly receive thousands of dollars in venture capital or other income. As well, many first- and second-year project teams propose machine learning as an innovation without demonstrating how their prototype will collect, analyze, or make decisions based on data. Although faculty have responded with additional course material about project funding and use of machine learning in prototypes, these results may indicate room for growth on this particular programmatic outcome.

Discussion

Results from this study contribute to conversations about the value of employing co-creation methodologies to develop transdisciplinary programs with industry and nonprofit partners. Our co-creation model facilitating transdisciplinary education and sociotechnical innovation also may provide opportunities for technical communicators who want to adopt studio coursework as an alternative or in addition to the service course. Those interested in adopting the co-creation model or employing co-creation methodologies in their programs, however, should be prepared to mitigate several challenges.

We use this section to discuss these challenges, including how to enable connectivity between industry partners, faculty, and students; to manage different expectations for the program; and to value the varied expertise of program stakeholders. We also discuss plans for more robust programmatic assessment and explore the potential replicability of the co-creation model.

Connectivity

Managing connectivity between stakeholders is one of the most difficult tasks in this program—and likely any program. The success of our co-creation model depends on the continued connectivity of our 75 industry partners. We manage connectivity by implementing feedback pathways between faculty and industry partners and showing these stakeholders how we are changing the program based on their ideas. For example, we host three on-campus events[5] and three hybridized events per academic year. These events regularly draw upward of 40 individuals and demonstrate the program's commitment to collecting their perspectives on the industry-motivated outcome areas that

5 We did not host these events during 2020 and hybridized events in 2021.

students examine in studio coursework. Sometimes, however, industry partners provide feedback that cannot be deployed in the program. In fall 2021, all members of an industry-partner focus group enthusiastically agreed that project development milestones should become a "Shark Tank" style pitch competition. Faculty disagreed, citing concerns about the impact of a contest on the overall learning environment. In this case, the moderator was able to redirect the focus group's attention back toward outcome areas, which are the responsibility of the industry partners to set. In this case, and other cases, ensuring connectivity between stakeholders requires regular communication about each stakeholder's roles and responsibilities within the program.

Even after ensuring that industry partners able to see evidence of their ideas at work within the program, we note that industry partners are mainly "a coalition of the willing." Although on-campus orientation and Expo events are well-attended, some student teams report having to seek out multiple mentors before finding one who has the time to regularly advise their project. Mentoring student teams is not an easy task; as industry partners find, students expect to meet with their industry partner(s) every other week online and touch base at the in-person events during the academic year. Industry partners review student deliverables, give feedback on presentations, and serve as liaisons to their industrial sector. Our industry partners report an average time commitment of 8 hours per month, yet we have found ways to maintain connectivity despite the time commitment of mentoring. Industry partners are more likely to agree to mentor student teams if those teams ask them directly for mentorship. Based on this finding, faculty teach students how to contact industry partners and remain in communication with them, but students are responsible for making the connections. Demonstration of student interest and motivation tends to beget interest and motivation in return from industry partners.

Expectations

Including industry partners within the co-creation model also means navigating conflicting expectations about their presence in the program. Incoming students often believe that industry partners are there to give them jobs as part of a feeder program. This mistaken belief prompts a welcome discussion about stakeholder theory, in which students are reminded that industry partners are not avatars of their employer but are people with their own skillsets and expertise. In alignment with this challenge, when students propose projects, they

must secure an agreement with an industry partner before the project pitch. These actions diminish mistaken beliefs about feeder programs; however, the "give them jobs" argument is harder to navigate. In truth, many industry partners are able to use their professional connections to help students progress through the internship hiring process. Neither faculty nor program administrators have asked industry partners to utilize their professional connections in this way. When industry partners have mentored students through the hiring process, they have done so because they served as a project mentor to the students over the course of multiple semesters and wanted them to succeed. Some students may have trouble interpreting this nuance of industry mentorship, though, and may believe that mentorship is a ticket to a job. (See Table 4.) Table 4 documents Student 4's quote that the experience of working with industry partners "did not really benefit me when it came to internship opportunities," evoking the false feeder program expectation. Faculty have responded to this concern by providing collaboration and networking resources to students with the aim of learning that interacting with multiple professional mentors is a lifelong process that improves professional development.

Because the co-creation model results in perspectives and feedback from all stakeholders, we can be challenged to navigate the different feedback we receive from these stakeholders. Students in particular report difficulty parsing the multiple perspectives present in feedback they receive from their course instructors, faculty mentors, and industry partners. Student evaluations of the program exemplify the frustration that students experience as they receive conflicting advice from the many mentors on their project team.

Table 4 shows student feedback about experiences with industry partners. Although frustrating for those teams trying to determine how to move their project forward amid multiple opinions, faculty have noted that navigating conflicting opinions is a common workplace experience and one that is likely to be useful for students' professional development.

Expertise

The program model also yields interesting questions about expertise, particularly regarding the disciplinary expertise(s) of students and faculty. As earlier results suggest, students learn transdisciplinary skills in our program through both formal and informal means. Insisting that students learn transdisciplinary skills can result in crossing disciplinary boundaries, sometimes uncomfortably. Students often report discrepancies between the projects assigned in disciplinary coursework

Table 4. Selected student reports of frustration with different advice given by project mentors as well as different communication and collaboration styles

Student	Comment about Conflicting Advice or Communication from Industry Partners
1	When we presented to industry partners, it seemed like they were unaware of where we were at in the course content. For the PDR presentation, they asked mainly business case questions when students had two days to put theirs together and were unfamiliar with the details they were looking for.
2	I think overall it was really interesting to meet and talk to them all, but I think a lot of them don't fully know what we're doing and then there's some awkward moments of "oh we're not actually doing this"
3	My experience with the industry partners was good. Although they might not have had as much knowledge about the specifics of our projects, they asked good questions and were engaged.
4	I found that interacting with these people did not really benefit me in ways that I had originally thought. I was stressed for the presentations I had to with these people present, but the after conversation did not really benefit me when it came to internship opportunities.
5	My experience with industry partners was limited so my opinions are also limited. I felt that some of the questions that the industry partners asked were very outside of what we learned so it sometimes became difficult to understand how to approach their feedback. A potential solution to this is to debrief those being presented to so they have a general sense of what the students know so their questions don't go to outside of it.
6	It was often hard to find times that worked for them and us. Maybe establishing a weekly office hour where the industry partners mark off a time to meet with students in the program. While this is likely not feasible since they are working professionals, some sort of system should be established to streamline this process.

Table 4. Selected student reports of frustration with different advice given by project mentors as well as different communication and collaboration styles (cont.)

7	I enjoyed the first meeting we had with them, but I felt very unprepared for it. The biggest issue I had is they're incredibly hard to get a hold of. I've emailed many and only one has ever responded, even though some directly gave me their cards. Many asked engaging questions and were wonderful to talk with during the expo and early presentation, but poor when online.
8	It was awesome that the industry partners were so available and willing to help. However, they were often very confused on how the project worked/what our problem space was, and how to help us beyond just giving us their thoughts.
9	I think some industry partners do not completely share CHDPs vision for maintaining and improving the human component of the system (as seen by the questions asked to the cobot drilling team)
10	I felt like it worked very well this semester, and we had less problems with Industry partners going off topic and making our project more confusing. All of the industry partners we met with this semester were very helpful.
11	There was much less interaction between the groups and the POPs when compared to freshman year. Also they seem to have way more technical difficulties than average people.

versus the industry-motivated projects assigned in the program. These discrepancies play into conceptions of student expertise. When students join the program, they often believe that their major determines the work they do on a team. Engineering majors commonly believe that they will build the prototype, design majors that they will make the presentation, business majors that they will write the business plan, and communication majors that they will write the project report. As students learn from faculty mentors and industry partners, however, this siloed approach to expertise has resulted in the disparate feedback and haphazard communication that they find so frustrating. Yet as students continue to complete coursework in their home discipline, students find themselves caught between two different educational models.

Traditional perceptions of disciplinarity cause further problems for students hoping to apply for internships outside their traditional major field. Students majoring within the College of Engineering (approximately 30% of students in the program) rarely seek internships outside engineering. Students outside engineering, however, often are interested in leveraging their status in the program to apply for internships outside their traditional major field. We have found that getting to the interview is the biggest hurdle that non-engineering students must surmount for internships they are otherwise qualified for. One of the authors reports issues with application portals rejecting applications from students not majoring in engineering, despite those students having both the coursework and project-based learning experiences to validate their expertise. In these cases, students must rely on connections with industry partners to get past the application and into the interview pool. This process is frustrating for everyone involved, and unsurprisingly, some students return to seek internships within their traditional disciplinary expertise. This problem illuminates a potential area of growth for the co-creation model; if our stakeholders are truly enthusiastic about transdisciplinary education and sociotechnical innovation, we hope that they will liaise with human resources to shift the application portal's programming. As we have found, however, sometimes industry partners do not know how the application portal at their company works. This issue remains a concerning limitation for students hoping to apply their transdisciplinary expertise outside of their traditional major field.

The question of (trans)disciplinary expertise also occurs with faculty teaching in the program. Core faculty are often regarded subject-matter experts within their discipline but may have trouble convincing students, industry partners, and other faculty that their perspectives are valuable outside their traditional disciplinary fields. Moreover, faculty have found themselves reckoning with difficult questions about the disciplinary place of the coursework they teach. For instance, one of the authors is designing the six credits of technical communication coursework that all students in the program take. Although some coursework in the technical communication sequence is typical for the field, like professional writing and user experience design, students also receive instruction that is less common in technical communication coursework, like digital prototyping. In this case, these instructional differences provide interesting conversations about conventions of technical communication pedagogy.

Moving Forward: More Robust Programmatic Assessment and Scalability

The program's pilot phase is expected to end in academic year 2023–2024. At that time, program administrators and faculty are expected to provide more robust programmatic assessment data about 1) student growth in the program, 2) necessary transdisciplinary coursework, and 3) scalability. We address our plans for achieving these goals below.

Student growth in the program. Most programmatic assessment is currently qualitative. Whereas internship and other numerical placement data are useful to support our claims about the program's value, we aim to increase our capacity for quantitative assessment through analysis of student deliverables. For example, vector analysis of student project reports and process books may provide quantitative evidence of change in discourse over time. Results may then be used to support claims about the impact of the program on student growth.

Necessary transdisciplinary coursework. Our stakeholders are interested in determining what and how many courses are necessary to deem an education transdisciplinary. Although we do not necessarily endorse this approach to transdisciplinarity, we intend to examine student project deliverables and overall impact on academic experience across other university studio courses. Because our program is the only program that requires transdisciplinary coursework in conjunction with studio enrollment, results could yield interesting conclusions about the value of transdisciplinary programs versus transdisciplinary courses.

Scalability. Our industry partners are interested in scaling this programmatic model for use at other universities. Ongoing programmatic assessment efforts are focused on determining the essentials for implementation, including funding amounts, core faculty makeup, likely academic programs to work with, and industry partner recruitment from additional governmental and nonprofit sectors.

Limitations

We note several limitations with potential replicability of this model for program design including place within the university, availability of funding, and recruitment of industry partners. First, this program is housed within an honors college. The already interdisciplinary nature of our institutional home assists with our ability to recruit faculty from across disciplines and enroll students from different majors. Deploying the co-creation model within a more defined disciplinary home might lead to constraints in these areas. Second, the funding situation in our

program may allow us more flexibility to make programmatic decisions that support our stakeholders. Finally, we note that our ability to recruit industry partners may be influenced by our institution's reputation as a large polytechnic university.

Conclusion

This project used a co-creation method to develop a transdisciplinary program focused on sociotechnical innovation. Using this model for co-creation, we worked with stakeholders to determine and implement goals for programmatic outcome areas, coursework, and project-based learning. Co-creating these elements of a program with stakeholders, including industry partners and students, has resulted in programmatic growth and strengthened the program's focus on transdisciplinary education and sociotechnical innovation. We examined the co-creation model's impact by analyzing programmatic assessment data from industry partners and students, as well as results from student project development milestones.

Results suggest that the model has influenced program growth due to the addition of more industry partners, more participating majors, and increased numbers of students who have expressed interest in joining the program. The program's focus on transdisciplinary education and sociotechnical innovation is supported by student experiences at learning skills outside their home discipline, internship placement information, and an increased number of high-fidelity prototypes delivered by student project teams.

Technical communicators who seek to engage stakeholders within program design via co-creation methodologies should be prepared to codify pathways for stakeholder connectivity to their program's students and faculty. These pathways for stakeholder connectivity facilitate conversations about expectations and expertise of different stakeholders within the co-creation model.

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From Anecdote to Evidence: One Program's Efforts to Define STEM Collaborators' Perceptions of Successful Writing Instruction

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Abstract. What do STEM faculty perceive as evidence of success in terms of the writing courses that they design for their students, and how can instructors use the evidence they provide to market our courses and program to other departments on campus? To begin answering these questions, we collaborated with STEM faculty in a preliminary stage of participatory assessment research to learn what they understand as evidence of our undergraduate science-writing course's learning benefits. We conducted a focus group that revealed preliminary evidence about colleagues' definitions of success related to our course, including the improvement in metrics that concerned STEM faculty; improved writing skills important for their students; and progress on intangibles related to writing, such as maturity and flexibility, that were previously invisible to us. These insights provided us with the language and criteria to design a framework to advance our collaboration and construct additional assessment research that can result in more evidence of what makes writing instruction successful for students in the sciences.

Keywords: Participatory Assessment, Program Assessment, Writing Instruction, STEM Collaborations

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STEM faculty who collaborate with technical and professional communication (TPC) faculty anecdotally highlight the success of our undergraduate and graduate science-writing courses, expressing gratitude for how the courses have dramatically improved students' writing. But what do these STEM faculty perceive as evidence of this success and how can TPC faculty use this evidence to market our courses and program to other departments on campus?

This program showcase article discusses our preliminary efforts at gathering evidence from our STEM colleagues about what makes our courses successful and using that evidence to build an assessment framework to collect even more concrete information. To begin answering these questions, we collaborated with STEM faculty in a preliminary stage of participatory assessment research to learn what they understand as evidence of our undergraduate course's learning benefits. Although our project seeks to make visible the current contributions of our courses, we align with Kyle Vealey and Charlotte Hyde's (2015) stance that assessment can be a rhetorical act that not only solves current problems but also provides vision for future growth and development. Specifically, we plan to use the language and evidence that we found to improve our courses and to market those courses to additional campus constituencies.

To conduct this first phase of our research, we held a focus group with four STEM faculty associated with our science-writing course. Our focus group revealed a range of preliminary evidence providing us with concrete insights about how our colleagues defined success in terms of our writing course, including the improvement in metrics that concerned STEM faculty; improved writing skills; and progress on intangibles related to writing, such as maturity and flexibility, that were previously invisible to us. Based on these insights, we began to build a framework to advance our collaboration and construct more extensive assessment research. In this article, we provide an overview of scholarship about curricular success and participatory assessment; describe our course and the STEM faculty's course along with our history of collaboration; detail our analysis and findings; and explore the preliminary evidence we found. We conclude by demonstrating how TPC programs can use preliminary data to plan future curricular collaborations and participatory assessment research.

Scholarship Focused on Defining Curricular Success

Determining what constitutes success at the level of the academic program or course generally involves systematic assessment, which is

research, as Heidi McKee (2016) contended, although it is not always acknowledged as such. The scholarship around curricular research and assessment in TPC highlights the complex and multi-layered approaches needed for this type of work, requiring input from a variety of sources within the course and program and externally from the program or course's ecosystem (Carnegie, 2007). Building on Joanna Schreiber and Lisa Melonçon's (2019) work that emphasizes the need for continuous improvement in curricular design, Chris Eisenhart and Karen Gulbrandsen (2020) highlighted the importance of "using multiple, data-driven methods to place common curricular practice within larger contexts as a way to address institutional needs and goals" (p. 68). In this section, we provide context for our work through an overview of previous approaches to investigating curricular success.

Data-driven research constitutes an approach to curricular analysis at the program and course levels in TPC. Faculty scholars report collecting institutional data and publicly available government and other information to direct curricular decisions. Some scholars report using data about workforce trends and demographic statistics (Carnegie & Crane, 2018; Coffey et al., 2020), whereas others examine academic and trade publications to find "the conceptual and practical skills that academics and practitioners have identified as important" (Eisenhart & Gulbrandsen, 2020, p. 70). Within an institution, information about enrollment numbers in courses and programs (Eisenhart & Gulbrandsen) and student employment placement data (Coffey et al., 2020) constitute benchmarks that campus leaders can grasp. A number of studies outlined the importance of longitudinal enrollment data in courses and programs to support their efficacy (McKee, 2016) and "as a metric for programmatic success" (Eisenhart & Gulbrandsen, 2020, p. 71). Eisenhart and Gulbrandsen also have promoted examining longitudinal degree completion data to demonstrate the ethical nature of a program's recruiting and student support practices.

Direct assessment to analyze student work in light of course/program student learning outcomes (SLOs) purportedly works well for undergraduate program analysis (Coffey et al., 2020; Eisenhart & Gulbrandsen, 2020). To perform direct assessment meaningfully, faculty need both internal guidelines and external standards. For example, Nancy Coppola et al. (2016) referenced the evaluative standards proposed by the Joint Committee on Standards for Educational Evaluation, which proposes "five key attributes of evaluation quality: utility, feasibility, propriety, accuracy, and accountability" (p. 7). The values articulated within our field also

provide standards to inform program and course assessment. For example,

> The Technical Communication Body of Knowledge (TCBOK) (2016) through its early development in 2007 (Coppola, 2010) to its redevelopment in 2012 (Hart & Baehr, 2013) has attempted to bring together our disciplinary core competencies as a codified collection of knowledge assets for the profession to be used in contextualized instruction and assessment of the writing construct. (Coppola et al., 2016, p. 8)

Likewise in their revision of a specific course, Kathleen Coffey et al. (2020) wanted to account for "evolving values and research trajectories within the broader field of TPC" (p. 145), which include redefinitions of content, "circulation and networked writing, and user experience" (p. 145). To identify these core values in action, Chris Lam, Mark A. Hannah, and Erin Friess (2016) analyzed Twitter data from #techcomm for a specified time to determine the central concerns of a range of stakeholders as reflected in social media.

Participatory curriculum development and assessment constitute important methods for defining success for TPC programs and courses. Michael Salvo and Jingfang Ren (2007) defined participatory design as "built on a process of designing with users and stakeholders rather than designing for them" (p. 424). They caution that participation must extend beyond providing advice to completing research and design in conjunction with users and other stakeholders as actors. To place stakeholders as central to the process, Salvo and Ren have viewed curriculum as a technology that can be investigated and redesigned for better usability on behalf of specific populations.

Participatory assessment and program/course design are layered processes that rely on overlapping sources of information to locate and contextualize the degree of success achieved by the curricula in question. For example, in their Design for Assessment Model, Coppola et al. (2016) garnered evidence from numerous sources including curricular structures and the opinions of students, current and former. Previously viewed by institutions as "noise," student feedback becomes a central source of evidence in participatory assessment (Salvo & Ren, 2007, p. 425); the input of students should be integrated into evidence from curricular review and from surveys/interviews of instructors and administrators (p. 426). McKee (2016) also used surveys of current students to evaluate their reconfigured program, asking what attracted them to the major, what major they would have chosen if this one had been unavailable, and what they would like to see in the

curriculum moving forward (see also Coffey et al., 2020).

This last question connects with Salvo and Ren's (2007) assertion that "the model we propose views program assessment as identity building, a process of identifying and articulating not only who we are but also who we want to become" (p. 426). Teena Carnegie and Kate Crane (2018) also emphasized the importance of using a multi-layered and iterative assessment process with participatory elements to design a forward-looking curriculum; they review published research and data and conduct interviews with their graduates (p. 28) to inform their efforts.

In addition to gathering participatory assessment data from students, scholars have targeted other stakeholders within their institutions as sources of information. Coffey et al. (2020) identified key stakeholders in a constituent major and interviewed them to participate in enhancing the curriculum. Their truly participatory approach is reflected by "providing faculty and administrators in related programs…access to the set of materials [they] created for PW instructors teaching the course, so they could evaluate how the revised course could continue to function in their own programs" (p. 156).

In the next section, we detail how we collaborated with STEM colleagues to create a junior-level course, "Writing in the Scientific Disciplines," for students in environmental science; we then outline the first phase of our proposed assessment practice to research and articulate what is successful about our current course for the students enrolled therein. Drawing on Eisenhart and Gulbrandsen's (2020) approach, we consider assessment as a multi-stage and layered process. Our process is in the preliminary phase of developing a framework, including locating relevant terminology, to analyze the success of this course in concrete terms and to discover what it contributes to science students' skills and to our STEM partners' curriculum.

Evidence Gathering Methods for Our Pilot Research

As a first step in our participatory assessment research, we sought to locate the terminology and criteria describing the successful outcomes of our science-writing course from the perspectives of our STEM colleagues. Using our shared terminology, we determined that we can build a robust research framework to collect direct and participatory assessment information to further enhance the course and market it to other departments. To begin unpacking what success means to our colleagues, we completed two types of analyses:

1. a review of documents relevant to our course "Writing in the Scientific Disciplines" (subsequently called our science-writing course) and the course for which ours prepares their students, "Seminar in Environmental Sciences" (subsequently called the Environmental Science (EVS) capstone course);
2. a focus group discussion with key stakeholders from EVS and the library who are responsible for the design of our collaboration and the delivery of the EVS capstone course.

Below we provide a brief history of the collaborative development of our science-writing course, our document analysis, and the justification and process for conducting our focus group meeting.

Brief History of the Development of Our Science-Writing Course

In Spring 2015, we were approached by the Department Chair of Environmental Studies (now EVS) and asked to reserve a section of our science-writing course (a precursor to our current course) for their students. As enrollments revealed, beginning in approximately 2010, students from EVS had comprised from one quarter to one half of the 20 students enrolled in our science-writing course each semester. Because the course was also an optional requirement for majors in our professional writing track, we decided to develop a separate course for EVS students. We worked with TPC faculty to craft a series of assignments and syllabi, which we then discussed with the chair and incoming chair from EVS. From the start, our course design was contextual, as defined by Kirk St.Amant (2018), as we endeavored to address the needs of the EVS program and their students in our initial course proposal. Our science-writing course was added to the undergraduate catalogue in 2015 and was also approved as an optional course in our major, a requirement for EVS students, and a prerequisite for the EVS capstone course.

Each year, we have added sections of our science-writing course as EVS has grown in size. Most recently, we scheduled four sections of the course for Fall 2022, and all seats are currently full. We continue to meet with EVS faculty each year to negotiate the content of our science-writing course, gain support for new hires in TPC to teach science-writing (see also Arduser, 2018), and plan additional curricular collaborations.

Document Analysis Process

In investigating the origins of our science-writing course, we located

the course proposal that we submitted to create the course and the data that we collected about enrollments in the course's precursor class over seven years. We also examined the sample syllabus for the course and compared it with recent syllabi, noting the evolution of the SLOs. Finally, after the focus group meeting, we collected a syllabus, assignment descriptions, and some rubrics for the EVS capstone course and found that reviewing these documents provided us with additional concrete information about what we are preparing the students in our science-writing course to do. For example, we discovered that the senior project as described in the EVS documents is more flexible from a genre perspective and developed through a more iterative process than we were expecting.

Justification and Process for Our Focus Group

To collect preliminary information about how faculty from EVS defined success in terms of our science-writing course and how well it prepares their students for the EVS capstone course, we organized and recruited colleagues for a focus group, which was designed to last about one hour. We submitted the design of the focus group, our recruiting email, prepared questions, and a consent form to our campus IRB and received an exempt status for this portion of our research. Despite our exempt status, we made all IRB recommended changes to the study design. We elected to conduct a focus group to spark "memory, experiences, and ideas" from participants (Tracy, 2013, p. 167). This format also allowed us to observe how our participants responded to certain concepts as a group and how each individual's comments would encourage more concrete observations and recollections from others.

For participants (see Table 1), we recruited the past department chair, who began the collaboration with us; the current chair; the incoming chair (currently the assistant chair); an assistant professor who teaches the EVS capstone course; and two lecturers who also teach the EVS capstone course. We recruited the participants through email and offered boxed lunches during the session through support from our Center for Teaching Excellence. Because he is retiring, the previous chair declined our invitation as did the assistant professor and one of the lecturers. The senior lecturer, who did attend, requested that we invite the EVS liaison librarian, who supports the EVS capstone course by holding consulting meetings with students and assisting with their research.

Table 1. Focus group participants

Role	Description
Current Chair	Full professor who created the EVS program and has forged and sustained our collaboration. (He communicates with us at least once a semester.)
Incoming Chair	Associate professor who has taught the graduate capstone course and teaches other upper-level undergraduate courses.
Senior Lecturer	Senior lecturer who has taught the undergraduate capstone course since the beginning of our collaboration with EVS.
Liason Librarian	Academic research and engagement librarian who works with the EVS capstone instructors and meets with students individually to address research fluency and assist in topic development.

We prepared nine questions in advance of the forum (see Figure 1), and we secured permission to record our conversation for record-keeping and accuracy purposes. We met in a designated faculty space within the library. After our lively 1.5-hour discussion, we transcribed the conversation, reviewed it, and identified central themes which we will detail in the Analysis and Findings section.

Figure 1. Questions prepared for the open forum

1. What are the goals of the EVS major?
2. What does the successful graduate look like? What are you looking for?
3. How does the EVS capstone course fit into helping you achieve the major's goals?
4. What assignments (documents) do you use to know whether you're preparing students to think and do? How do you assess these assignments, documents?
5. What did you hope that your students would gain from taking our science writing course?
6. What seems to have improved related to their writing and communication? What have you observed?
7. Have you seen this improvement in the assignment you mentioned before? How so?

Figure 1. Questions prepared for the open forum (cont.)

8. What do you hope to keep seeing?
9. What would you like more of or to have changed?

Analysis and Findings

After our focus group session, we determined how to process the documents and rich discussion that we recorded. Although our focus group began with prepared questions (listed in Figure 1), we transitioned to an organic and less structured discussion. All participants contributed evenly to our discussion and seemed willing to speak freely. As the department chair indicated at the end of our discussion, the curricular collaboration that EVS has with TPC colleagues is unique in their experience because TPC faculty repeatedly ask for meetings with and feedback from EVS about how well our courses are serving their students. This recognition of the foundation for trust and collaboration that we cultivated over time certainly allowed the focus group to yield useful insights.

Because we view this portion of our research as preliminary, we couch our findings below similarly. Our goal was to locate the language that unpacks what our EVS colleagues mean when they call our course and collaboration a success so that we can then construct an empirical evaluative framework to use in directly assessing our course and soliciting feedback from students and other stakeholders. Our analysis of the documents and focus-group feedback below advanced our understanding about how our colleagues view what our science-writing course accomplishes for their students and did so in some expected and other surprising ways.

Document Analysis

Our document analysis focused on the course action form that created the science-writing course, the sample syllabus attached to that form, a recent science-writing course syllabus, and the syllabus and capstone assignment description and rubrics for the EVS capstone course. Our course action form indicates that the purpose of the course is to explore "writing in academic contexts" and "the multiple practical strategies scientists use to communicate in professional settings." This focus was determined after several discussions with the EVS department chairs, current and former, who provided insights about their students' needs. However, as we found from our focus group, we did not have a complete understanding of how the course could contribute to EVS curriculum.

The science-writing course sample syllabus attached to the course action form contained five general SLOs:

- To recognize a scientific discipline or group of disciplines as a specialized community of discourse;
- To critically consider the products of science and science's role in the complex problems of human societies;
- To read, interpret, and produce writing in academic genres;
- To develop rationales for effective accommodation of academic science for various expert stakeholders; and
- To use various tools and modes to produce texts for academic audiences.

As these SLOs reflect, the course was originally centered on academic writing. We saw a need to focus on scientific discourse as a unique communicative approach for creating and disseminating ideas; however, we did not directly mention design beyond hinting at the use of "tools and modes." Because we had not yet taught the course before establishing the SLOs, we were unsure about what was needed beyond what our EVS colleagues told us. The assignments parallel these SLOs, asking students to produce only academic genres such as a literature review, research paper, and research poster.

In subsequent semesters, we gained more knowledge about our students and their needs and developed a more expansive list of SLOs that expanded the focus beyond academic writing:

- Summarize and compare the findings and arguments expressed in scientific scholarship.
- Explore issues of subjectivity in relation to scientific discourse.
- Write effectively about scientific issues and topics for a variety of audiences and types of publications.
- Develop an effective writing process involving invention, drafting, responding to feedback, and revision.
- Learn and employ primary and secondary research strategies to locate scientific findings, debates, and data to support writing assignments.
- Write persuasively yet fairly about complex and controversial scientific issues and ideas, drawing on the conventions of science-writing modeled in course readings and discussed in class.
- Design texts for a variety of audiences and contexts.
- Demonstrate the ability to create clear, persuasive, and appealing graphic elements and visual designs informed by basic design principles.

As these revised SLOs reflect, we incorporated more theoretical concerns, including subjectivity in scientific discourse and negotiating

controversies as well as instruction in visual rhetoric and design. We also added a project asking students to use their scientific expertise to write for external audiences.

We collected documents from the EVS capstone course after the focus group because we thought the participants would be more willing to share materials after learning about our work. The senior lecturer sent us her syllabus, schedule, capstone project assignment description, and rubrics. The SLOs for the EVS course parallel ours in ways but are less detailed and specific:

- Demonstrate the ability to critique ideas and opinions on advanced topics in environmental studies;
- Have the ability to present information, both written and oral, on an advanced topic in environmental studies using modern techniques and technology; and
- Have a polished resume and cover letter prepared for immediate use on the job market.

The first SLO surprised us, as it seems to relate more to rhetorical analysis than concrete writing tasks related to EVS. Like our initial syllabus for the science-writing course, the EVS SLOs generally reference "modern techniques and technology" for writing and design. Finally, the requirement to create employment documents was also enlightening.

The capstone assignment description and rubrics were also interesting as they emphasized the focus on writing process and genre flexibility, which we learned about during the focus group. The students receive comments on a number of drafts of their capstone projects; earn credit for meeting with the teaching assistants (TAs) and the librarian; and submit early planning documents, including a proposal brainstorming form and a research pitch. Furthermore, students have flexibility regarding the genres that they can produce, which directly contradicts our previous understanding that we were primarily preparing the students to develop academic research genres. Finally, the rubrics are less descriptive and more focused on quantification than we were expecting. For example, the rubric for the project draft identifies required elements and tasks that are graded on a yes or no basis. The quantification and tight parameters for assignment grading may reflect the fact that TAs are primarily responsible for grading early submissions.

These are matters that we need to explore in future phases of our research.

Focus Group

Our focus group discussion lasted 1.5 hours, during which we had a lively conversation with our participants that was spurred by some of our prepared questions but that evolved organically. We followed standard practice for analyzing the qualitative data gleaned from the focus group, including recording and transcribing the data and analyzing for themes (Breen, 2006, p. 466). We each reviewed the recording and met to discuss what we learned, and the first author created a transcription for our reference. Based on the recording, the transcript, and our subsequent conversations, we developed three themes in which we could place the significant feedback about how our course was characterized as successful from the perspectives of our participants. These themes included the following: improved metrics, improved writing skills, and progress on intangibles.

We also analyzed the transcribed discussion for the frequency, extensiveness, and intensity of the remarks made by our participants. Our 1.5-hour conversation was too short to make frequency a helpful measure; we found that extensiveness and intensity were more revealing. That is, some topics were discussed by multiple participants (extensively), and some topics were mentioned with more "intensity, passion, or depth of feeling" (intensity) than others (Krueger, 1998, p. 36).

Finally, each participant repeatedly emphasized the benefits of our science-writing course on their students' writing, using a range of evidence to support their assertions. This information was offered in response to direct requests from us for clarifications and specific examples. In the subsections below, we discuss each theme, its extent and intensity, example quotations, and the evidence offered or implied to support the observations. We also include Tables 2, 3, and 4 to visually illustrate how our focus group assisted us in beginning to understand our STEM colleagues' perceptions of what counts as evidence of success regarding our course.

Improved Metrics. Improved metrics (see Table 2) was the first type of evidence cited by participants; it was intensely stated but the least extensively discussed. Participants began answering our questions by citing an increase in grades on the central assignments in the EVS capstone course and in the class overall. Two of four participants cited grades as evidence, both discussing this topic ardently and emphasizing how dramatically their students' grades have improved. They mentioned that the majority of students previously received failing grades on the first drafts of their projects and now receive grades

closer to B-. Though they did not have specific grade-distribution data on hand, they offered to send us this data.

Table 2. Improved metrics theme

Topic (# of participants	Sample Quotations	Implied or Stated Evidence
Grades (2)	"Literally almost everybody in the class now gets As because their writing is that dramatically improved." On early draft assignments, "the average grade was between 37–42%" and is now sitting "right around 80%."	Grades on assignments, overall semester grades
Completion of Capstone Course (1)	Fewer withdrawals, Ds, and Fs in the course	Drop rates, grades
Grading (1)	"TAs used to spend 4.5 hours on average commenting on [early draft] submission... and that has dropped down to 2 hours because the increase in the students' ability to write is through the roof."	Time spent grading, substantive comments versus focus on mechanics/sentences

Other improved metrics included the amount of time that instructors and their TAs, who are graduate students in EVS, spend grading and commenting on students' drafts. The senior lecturer highlighted the drastic differences she observed in TAs' grading time since our science-writing course became prerequisite for the EVS capstone course; she reported that the TAs previously spent on average 4.5 hours commenting on initial drafts of students' capstone projects and now spend about 2 hours. In addition, both the senior lecturer and the assistant

chair mentioned an increase in the number of students who successfully complete the course and a decrease in the number of failing grades (Ds and Fs). Though the improved metrics topics were associated with the most tangible types of evidence, these were the least discussed. As the following two subsections indicate, our participants were more interested in their students' progress on writing skills and intangibles.

Improved Writing Skills. Participants discussed four general topics relating specifically to their students' improved writing skills (see Table 3). Though discussed less extensively than the other two categories in this theme, science-writing virtues and research competency were highlighted with a matter-of-fact tone. In response to a direct follow-up question, science-writing virtues, including clarity and cohesion, were mentioned as specific aspects of improvement in their students' writing.

Research competency was a topic emphasized primarily by the librarian. The librarian noted that, after students began taking our science-writing course, they spoke differently about and demonstrated advanced research techniques. The librarian reported that, when students were asked where they will search for information, they no longer said "in the library database" but were more likely to mention specific databases, such as Web of Science or BIOSIS Previews. The senior lecturer noted similar changes related to research proficiency among students, and both the senior lecturer and librarian remarked that the students' abilities enabled the instructors and TAs to discuss higher order research concerns earlier in the course, such as why students choose to cite one scholar over another and examine who is included in and omitted from students' reference lists.

The writing skills topics that participants discussed more, as noted in Table 3, include writing maturity and genre fluidity and creativity. These topics were less concrete than science-writing virtues and research competency. Each of our participants mentioned multiple instances in which they were surprised by students' higher-level handling of their writing processes, and they saw students taking the initiative to engage in substantive drafting and revision. The senior lecturer used phrasing like, "I used to have to teach this but now…." The assistant chair mentioned that her students have started to acknowledge scholarship more often, including in-text citations even in less formal genres like discussion posts. In discussing these points, the participants mentioned wanting more research to determine if students who performed at these higher levels of writing maturity in other classes beyond their EVS capstone course had taken our science-

Table 3. Improved writing skills theme

Topic (# of Participants)	Sample Quotations	Implied or Stated Evidence
Science writing virtues, clarity, cohesion (2)	"Ultimately, just the clarity of their writing is better, the continuity is there; they're submitting entire papers and not just [incomplete] drafts... It's all there, not just bits and pieces."	Writing artifacts like seminar papers and presentations
Research competency (2)	"I've seen correlation between those who take the science writing course and being able to then articulate specific tools they'll use through the library to focus on their research questions." "So just in terms in how they think about sourcing and searching for their information is an improvement...."	Students' justifications for searching techniques and sourcing choices in conversation and presentation, citation accuracy and range of voices in sources noted in papers
Writing maturity (4)	"They've finally gone through enough writing experience...[that] they're understanding the difference between, outlining, brainstorming, outlining, drafting, final submission." In discussion board responses, "I don't ask for citations or things like that but they're putting citations at the bottom, they're in-text citing...They're [writing] cohesive[ly] on the discussion board!"	Less class time spent justifying drafting in a structured writing process, high-level writing practices applied to less-formal assignments
Genre fluidity and creativity (4)	We had "one student who wanted to write a patent for a medical device; she got the patent.... We've had students write management burn plans for nature conservatories that have been implemented.... We've had environmental videos. More and more websites are being done. A lot of them are using them for their side hustle business."	Outcomes from students' work, such as submitted reports, patents, presentations at conferences, and community engagement work

writing course, which is precisely where we hope to take our research.

Genre fluidity and creativity referred to students' ability to extrapolate their skills in writing scientific research and to apply them to other genres. The senior lecturer explained that outward facing genres are not taught directly in the EVS capstone course but that students determine which genres to use for their final capstone texts and direct themselves through research and writing in those genres. Using a flexible approach to genre was discussed in reference to students' exigence for their self-chosen senior capstone projects. The participants did not use the word "genre" and instead talked about students' ability to be creative and fluid in terms of the types of texts they composed connected to their career success in EVS fields. Some of the genres mentioned included business plans, environmental management and burn plans, patent applications, and site assessment reports.

Progress on Intangibles. Our last theme is progress on intangibles (outlined in Table 4). The categories of remarks within this theme comprised the most unexpected feedback about what success means to our participants. Two of the less extensive intangible topics talked about were emotional resiliency and teacher experience. Two participants noted that students seemed less stressed with the capstone course's writing expectations since taking our science-writing course. Students entering the capstone course appeared to anticipate a certain amount of discomfort associated with taking a writing-intensive course. When they received feedback on their writing, students seemed to process that feedback more productively and less defensively. They also more effectively used the tiered writing structure of the course, which was evidenced by students submitting complete assignments even during the drafting phases of the project. Previously, drafts, for instance, may have consisted only of lists or incomplete thoughts. Through their experience in our science-writing course, they have learned that more complete drafts result in more productive feedback.

Another intangible observation is the quality of experience that TAs and instructors reported when teaching the EVS capstone course. As the students' writing has improved, the class has become more enjoyable to teach. Higher grades mean that teachers and TAs spend less time justifying grades and defending their feedback. Because students had more writing experience and utilized more effective writing processes, teachers could prioritize helping students pursue their interests and passions, finding ways for them to complete a wider range of

genres in their capstone projects.

Table 4. Intangible observations theme

Topic (# of Participants)	Sample Quotations	Implied or Stated Evidence
Teacher experience (2)	The improved writing abilities leading to more students getting As "makes it much more enjoyable experience for our TAs" and "enjoyable for faculty of record."	Fewer student complaints and better work
Emotionally Resilient (2)	"I've seen a marked improvement in less stress! The fact that the students have gone through this style course with you all in your science writing course coming into our capstone course, they come into it with that expectation of stress...."	Improved attitudes of students
Adaptability (3)	"I haven't had a student complain about feedback they've received in ages."	Fewer complaints, better use of feedback
Confidence (3)	I would like to "actually try and measure in some way, do students who take the science writing course feel more confident about their approach to capstone... vs. students who haven't taken the science writing course and their doing that for the first time."	Students' positive attitudes and lack of fear
Flexibility (4)	"One of the things I've observed over the years is that in EVS there are a lot of different pathways that students can take to get to the center of the tootsie pop...." "Students who have expressed they've done the science writing course... seem to feel more comfortable to step out of writing the standard scientific research paper and try something new."	Creative response to the course requirements in terms of genre production

Each participant discussed the apparent rise in students' adaptability and confidence in meeting the demands of the course and in applying their writing skills in a range of scenarios. Participants communicated that they thought students were more successful and capable writers than they used to be, and they associated student success with confidence. Students were also better able and willing to process instructor feedback productively. Confidence seems to lead to adaptability and aids students to approach writing tasks with more interest and less fear. Our participants suggested a specific method for measuring this increased confidence: conduct a pre- and post-survey before and after students take our science-writing course and after they take the EVS capstone.

The last intangible observation made by participants is how our science-writing course seems to make students more flexible. Each participant mentioned that EVS students need to know how to communicate effectively with other scientists, experts in other fields, and the public. Although they did not use the words rhetoric or rhetorical situation, they mentioned how students seemed comfortable adjusting their writing tasks to meet the demands of new contexts and audiences. Our participants emphasized the impossibility of preparing students for all possible contexts and genres, and they stated with exclamation (high intensity) how students were able to adapt and be flexible instead of producing only familiar academic genres. They returned to this topic throughout the entire discussion and referenced it in relation to the skills that students need for success in future organizational contexts in EVS. One participant even asked us if we taught students how to argue so that they could be prepared to spontaneously defend their perspectives to skeptical publics.

Discussion of Our Results and Future Directions for Research

We designed this first stage of our multi-layered and multi-stage participatory assessment research to discover the language and criteria that our STEM colleagues in EVS use to frame preliminary evidence for what constitutes success in terms of our science-writing course. We were able to use our focus-group discussion to locate specific themes unpacking the ways that our course successfully prepares EVS students to become better writers and researchers prior to entering their capstone course. Discovering a shared or "neutral language" for discussing writing was crucial to our participatory approach (Spinuzzi, 2005). As Clay Spinuzzi noted, in participatory research and design, neutral language can help bridge "the worlds of [designer] and users by finding a common… mode of interaction" (p. 166). Incorporating our STEM

partners' language and perspectives into our assessment research gives them an active role in shaping the future development of our assessment framework. In the subsections below, we explore the expected and unexpected results from our research, the importance of these results for revising our course and marketing it to other STEM programs, our next steps in participatory assessment, and the limitations of our work.

Expected and Unexpected Feedback

When we planned our focus-group research, we anticipated that our conversation would center on how our science-writing course provided EVS students with improved writing skills. We expected, for example, to discuss topics relating to basic writing literacies (Cargile Cook, 2002), including proficiencies that have long been heralded as science-writing virtues, such as "accuracy, conciseness, addressing audiences appropriately" (Ballard, 2018, p. 62). Like Thomas Ballard, we found that STEM faculty considered these types of skills as evidence of effective writing, and we learned that our STEM partners have seen their students improve in these practical skills (seen in other TPC programs, per Kynell, 1999).

Also expected were our colleagues' discussions about students' ability to research. Our findings align with the central place that research competency has held in technical communication for at least the last two decades (e.g., Hart-Davidson, 2001; Stanford et al., 2017). Our course devotes close to one third of the semester to literature-review writing and the other two thirds to writing and presenting research. The improvement in research skills, therefore, was confirmatory to us.

Finally, we expected discussions about academic genres to be prevalent, and our expectations were both confirmed and challenged. Our participants never mentioned the need for their students to master a specific genre. Rather, they discussed genre concepts in reference to students' need to be nimble and flexible to succeed as environmental scientists. One participant explained that, for EVS students, "One of the things I've observed over the years is that in EVS there are a lot of pathways that students can take to get to the center of the tootsie pop." In other words, students will not be restricted professionally to writing formal science-research papers; they need to select from a range of genres including reports, plans, patents, podcasts, and websites to reach the audiences they encounter in their work.

The successful outcomes we did not predict came in the remaining

themes and topics: improved metrics and progress on intangibles including writing maturity, adaptability, and confidence. We discovered that our class contributes to helping students in concrete and intangible ways. Though we understand that metrics are an important measure of success, we learned which sources of data meant the most to our partners, including a rise in grades; a decrease in withdrawals, Ds, and Fs; and a decrease in grading time. For example, our STEM partners were so excited about the changes they saw that they cited the improvement in grades from memory, such as the 20% to 30% increase on draft grades and the surprising number of students earning As in the course.

We were also surprised by the citation of progress on intangibles as evidence of success, such as the increase in writing maturity that was both intensely stated and extensively discussed. Writing maturity referred to students' advanced writing processes and the decrease in students' stress. In their writing projects, students articulated complete thoughts, exhibited critical thinking, and endeavored to communicate beyond academic audiences and contexts. Our participants indicated that students no longer wrote in "bits and pieces"; they understood the difference between brainstorming, outlining, drafting, and final submissions and included citations and references, even in informal assignments such as discussion board posts. The senior lecturer said it best: "They've finally gone through enough writing experience" to do this higher-level work. Most importantly, we learned that our course alters students' approaches to writing and their abilities to process feedback more maturely and productively (adaptability). Although we include responding to feedback as a learning outcome for our science-writing course, we were unaware that we were directly addressing a difficulty that EVS capstone instructors previously experienced: the marked decrease in students' complaints about feedback and grades as a result of our course is exciting news.

Within the theme of "progress on intangibles," the participants also highlighted students' seeming confidence in navigating the uncertainty and lack of guidance in producing genres. We expected our participants to congratulate us on teaching their students to write specific genres like literature reviews and research papers, but they actually said they were grateful that their students could write beyond these genres. We thought we offered a course focused on academic science-writing, but our participants indicated that we were teaching their students intangible skills related to analyzing rhetorical situations

and to responding to them flexibly.

Much of the evidence connected to intangibles represented the type of tacit knowledge we needed to learn by inviting our STEM partners to collaborate in identifying what constitutes evidence of successful writing instruction. As many have noted (e.g., Moore & Elliott, 2016; Spinuzzi, 2005), a strength of participatory design lies in helping researchers and designers uncover users' tacit knowledge or "what people know without being able to articulate" (Spinuzzi, 2005, p. 165). Such knowledge, according to Spinuzzi, is "implicit rather than explicit, holistic rather than bounded and systematized" (p. 165). Through our organic focus-group discussion, themes like progress on intangibles (see Table 4), representing such tacit knowledge, were able to emerge.

Finally, we were surprised by what we did not hear. We anticipated more discussion of mechanical correctness and grammatical proficiency. However, our STEM partners did not laud such "how-to, practical… skills" (Scott, 2004) or the widely critiqued hyperpragmatic outcomes (e.g., Hashlamon & Teston, 2022) as the best features of our course. The majority of our conversation focused on rhetorical and research skills and intangibles. In the words of Ballard (2018), "the validation of technical communication as a discipline, and rhetoric specifically, found through this study has been a welcome finding" (p. 62).

Course Redesign and Marketing

Based on this first stage in our research, we will make specific changes in our science-writing course. We will revise our SLOs to highlight the intangible skills that we are providing, such as productive response to feedback and genre fluidity. Additionally, we have tried to incorporate more overt rhetorical instruction in the course, but we can now do so within the language of our STEM partners. Tone Bratteteig et al. (2013) explain that a shared language must be developed by "advocating 'home-made' description" (p. 134). For example, we can highlight specific stages in the writing process such as topic development; focus on contextual analysis necessary for environmental science; and highlight research skills specific to the projects students complete in their EVS capstone course. Finally, the most significant change will be centered on genre fluidity. Our focus on the research paper has always been problematic for some students who are not performing field research. Now that we discovered that students can benefit from exploring other research-based genres such as reports, plans, or white papers, we can integrate those options into the research portion of our course.

Part of our goal for this research was to learn how we can market our science-writing course to other STEM programs on our campus. Drawing on the language of success that we have gained, we can highlight the metrics and intangibles important for other programs in addition to our ability to assist students with writing skills. We can begin discussions with STEM colleagues by asking informed questions about the metrics that are important to each discipline, the difficulties that they experience commenting on students' writing, and the ways that students process their feedback. Approaching the marketing of the course through the lens of our unexpected results will aid us to communicate with other STEM colleagues and better address their needs and those of their students.

Next Steps in Assessment

The next steps in our assessment research will harness the themes we identified (consolidated in Table 5).

Based on feedback from our participants, we will collect data on grades, grading time, and withdrawal and failing rates. The data we collect will be course-level (semester grades) and assignment-level; our participants said that they track and are willing to share such data. As far as writing skills are concerned, we will use our revised SLOs and conduct direct assessment of students' writing from our science-writing course and the EVS capstone course.

To investigate intangibles such as confidence, we will survey students before our science-writing course, after the course, and before the EVS capstone course based on our participants' suggestions. We will also compare feedback on intermediate drafts to final versions of papers from both courses.

And, finally, we will collect capstone papers to analyze for flexibility by noting the range of genres created. Ideally, this analysis would be followed by a survey for students to indicate whether they published or otherwise used their capstone projects outside of their EVS capstone course.

Other TPC programs can build on both our approach to course design and the first phase of our participatory assessment research when developing or rethinking upper-level courses designed to serve students in other programs. Some of our assumptions about what STEM faculty value in writing courses and writing instruction proved invalid. As Ballard (2018) and others have found, values central to TPC also matter to faculty in other disciplines; however, we need to build spaces and structures to capture our shared understandings of what constitutes success in writing instruction. The initial framework (represented in Table 5) that we will use to guide our subsequent assessment

Table 5. Themes, future assessment framework, and sources of evidence

Metrics		**Writing Skills**		**Intangibles**	
Grades	Semester-level grades from past 4–5 years	Science-writing virtues	SLOs, student writing	Confidence	Student surveys before science writing and after EVS capstone
Grading Time	Information from TAs	Research competency	SLOs, student writing	Stress resilience	Student surveys before science writing and after EVS capstone
Rates: withdrawal, D, and failing grades	Data from university	Process maturity	SLOs, student writing	Adaptability	SLOs, comparing drafts to feedback and final drafts
		Genre fluidity and creativity	Capstone paper	Flexibility	Capstone paper, follow-up surveys

research can be adopted and can inspire similar analyses by other TPC programs that have or want to seek collaborative relationships with STEM disciplines.

Limitations of Our Initial Research

Overall, we were excited about the knowledge we gained from the first phase of our participatory assessment research. Nonetheless, we have identified limitations that we will rectify. Our focus group included a small number of EVS faculty and support instructors; we hope to speak with and survey additional faculty and the TAs, who provide student feedback in the EVS capstone course. We also approached our focus-group results in a less formal and systematic way than is optimally described in the literature. We were not seeking metrics of reliability because this was an exploratory study designed to elicit the main themes and language that we could build upon in future phases of research. Finally, we were not able to address the other course (master's level) that we offer to EVS students because of time constraints. We will incorporate this into our future analyses.

Conclusions

Learning what stakeholders consider to be evidence of successful writing instruction will vary from institution to institution. Nevertheless, value exists in seeking to understand stakeholders' points of view, not only what they hope to see from our programs but also what they are seeing. Our focus group helped us understand what our STEM collaborators view as evidence of successful writing instruction, including improved metrics, improved writing skills, and progress on intangibles—such as maturity and flexibility. The emphasis our STEM collaborators gave to specific metrics and intangibles surprised us and gave us the language and criteria necessary to create a framework (represented in Table 5) to advance our collaboration and construct more extensive assessment research. Though the specific assessment research presented here is unique to our case, the participatory approach we have shared will benefit other programs seeking to understand their work and to market courses to other disciplines.

As noted above, we benefited from having worked with our STEM partners for seven years prior to beginning this assessment research. Because we began this program collaboratively, and because we met regularly, we were positioned to receive informal feedback from our colleagues. Rather than impose our preferences and expectations for how to conduct assessment, we strove to understand in concrete terms what our peers were seeing so we could together determine why and how the course was working for their students. Most significantly, we found that our science-writing course provides much more than instruction on writing clearly and citing sources; it changes EVS students' relationships to writing and provides them with intangible skills that we did not anticipate.

In reviewing our work, other programs in TPC can learn about the questions to ask to learn more about their own courses and curricula and see their work through the eyes of their collaborators. The perspectives they find and the evidence they uncover may reveal, as it has for us, that their course provides much more than a service to their students: it provides a whole new perspective on writing and communication and prepares them on many levels to take on the work of their chosen fields.

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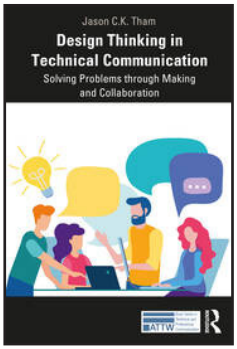

Design Thinking in Technical Communication: Solving Problems Through Making and Collaboration

Jason Tham

New York

Taylor & Francis
2021, 168 pp.

Reviewed by Bhushan Aryal

Delaware State University

The questions of how to make technical communication socially more responsive, bridge the academy-industry gaps and enhance the immersive active learning process have guided scholars in the field to find innovative ways to transform technical communication praxis. In this connection, Jason C. K. Tham's *Design Thinking in Technical Communication: Solving Problems Through Making and Collaboration* (2021) is a significant contribution as it asks technical communication stakeholders to be intentionally innovative to meet the challenges of the time and to be more imaginative in the possibilities afforded by the field. Tham shows where the field is in general and where it can or should be if it takes a more deliberate design-centric approach by placing social justice and users at its core. Written in accessible prose and peppered with personal anecdotes, the book is an engaging read that not only puts readers at the center of technical communication theories and practices but also is rich in the number of references it makes within the field as well as its interdisciplinary connections. Organized into

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five chapters and a conclusion, the book advocates for the design thinking approach and argues that using physical makerspaces in designing technical communication courses can change the outcomes significantly to promote radical collaboration, active learning, and social justice. If someone were to use three key phrases to describe the book, they would be "design thinking," "material immersion for effective pedagogy," and "radical collaboration for social justice."

Chapter 1: "Introducing Design Thinking (and Making) for Technical Communication" draws on the rich history of design thinking literature and develops a theoretical foundation for "the design (Thinking) Turn" for technical communication in particular and the writing studies field in general. Tham locates the origin of design thinking in multiple disciplines but emphasizes the design science and the Scandinavian co-design models of the 1950s and 1960s that many American universities have later adopted in varied forms for their different purposes. Characterizing it as "constructivist-constructionist" in nature, Tham defines design thinking as "pedagogical efforts" in "creating opportunities that let students attempt to solve [complex] problems" (p. 18). When connected with the current DIY culture and the "Makers Movement," the efforts can help students "solve technical communication problems through direct experience with tangible materials" (p. 17). Tham thinks that this move toward "the design and making turn" perfectly aligns with the other developments within writing studies, such as the current focus on multimodality.

Chapter 2 focuses on the ethnographic study of three makerspaces at the University of Minnesota-Twin Cities, Georgia Institute of Technology, and Case Western Reserve University, providing in detail their setup, the general workflow and processes, and the experience of administrators and participants in running the programs. Tham observes these makerspaces closely, interviews stakeholders, and discusses the activities in these labs in connection with technical communication's focus on user-center orientation and problem solving. In the process, he demonstrates how the "design-centric and material thinking" approach can go beyond the mere discussion of tools and shows how such an approach can connect technical communication pedagogy with the wider DIY Makers Movement (p. 27). Located at universities, the makerspaces discussed in this chapter are industrial in nature in the sense that they resemble miniature manufacturing plants in their structures. For Tham, they are material manifestations of how the academy-industry gaps can be bridged by designing college courses into collaborative projects that can reflect workplace collaboration that directly involves "making" things.

Chapter 3 connects design thinking with social justice and social innovation. Using interviews with industry practitioners, Tham highlights how technical communication is commonly understood in terms of "technical" and "effective communication" and how technical communicators' work is equally engaged in "user advocacy and social issues" (p. 75). The design thinking paradigm, he argues, can help technical communicators to be more intentional in their efforts for social justice and can lead them to "pursue leadership in social advocacy" (p. 75). Undoubtedly, pedagogical implications are imbedded throughout the book, particularly with the inclusion of learning activities at the end of each chapter.

However, Chapter 4 primarily focuses on pedagogy as it presents a case study of a service-oriented technical communication class, where the instructor uses "design and making thinking" and "social advocacy" to design the class, and students engage in active learning, making, and collaboration to learn "design thinking" for solving complex human problems. When designing the team projects, students are asked to be deliberate in their goals and to "empathize with users & stakeholders, define scope of projects, ideate radical solutions, create prototypes, test prototypes, iterate designs, [and] present or implement solutions" (p. 83). By discussing the course, Tham shows how being intentional about design thinking and social advocacy can be combined with traditional technical communication pedagogy to create an engaged collaborative learning experience.

Chapter 5 takes the issue of collaboration in technical communication as its focus and discusses how technical communication is by nature a collaborative enterprise. Building on this foundation, Tham goes further and advocates for "radical collaboration," which he defines as a more deliberate process that "seeks to flatten power structures with the goal to harness collective creativity in addition to individual expertise" and that "includes a diverse team" with "differing perspectives and ideas" that are open to "imaginative solutions" (p. 103). The chapter highlights the process strategies for such radical collaborations, demonstrates why being "radical" is needed to achieve social justice goals, and advises how "design thinking" assists to be deliberate about it. The concluding chapter brings the "advocacy" part of the author in full force, asking technical communication program designers, faculty, and industry practitioners "to create waves and cultivate change" (p. 121) so that they can shake up the field by practicing "productive disruption" led by the systematic methodologies of design thinking, critical making, and social advocacy.

While the book primarily focuses on individual courses, it also offers ideas to re-envision technical writing and professional communication programs by using design thinking and making approaches. Such programmatic revisioning can aim at a radical interdisciplinary or even transdisciplinary collaboration so that colleges and universities could create the physical makerspaces combining technical communication instruction with science and engineering. Undoubtedly, such a material infrastructure and the knowledge-work required to run that physical structure would demand resources (and may require academy and industry collaboration), but what Tham visualizes is an innovative praxis that asks technical communication program administrators and instructors to think of teaching as an immersive, learning-by-doing activity, which he advocates can be accomplished by using design thinking and makerspaces. In doing so, instructors can help students learn to solve knotty technical communication problems that include as much technical know-how as students should be aware of user-centered perspectives and social justice orientation.

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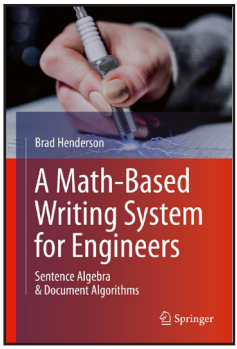

A Math-Based Writing System for Engineers: Sentence Algebra and Document Algorithms

Brad Henderson

Cham, Switzerland

Springer Nature Switzerland AG
2020, 357 pp.

Reviewed by Megan Boeshart Burelle

Old Dominion University

Grammar instruction and how it should be handled is an ongoing and contentious topic in composition and technical communication. Michael Knievel, April Heaney, and Meg Van Baalen-Wood (2010) trace the historical tension between writing instructor pedagogies that emphasize "rhetorical concerns like audience and purpose" (p. 58) and the skills-based pedagogies that have strong roots in the engineering discipline. Despite varied opinions, many technical communication instructors for engineers may find themselves in a position of needing to address grammar because of the company and client expectations that students will encounter in future. While there are a multitude of approaches, Brad Henderson's *A Math-Based Writing System for Engineers* (2020) provides one method that focuses on how the English language works at a sentence level. Knievel et al (2010) ultimately invite technical communication instructors "to reevaluate the role of grammar instruction in their own classrooms" specifically emphasizing that many students, "especially adult students continue

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to identify grammar and mechanics as the very crux of what matters in writing" and that grammar instruction can ultimately be a way to open up more conversations within technical communication classes on what makes good writing (p. 67). Henderson's book could provide technical communication instructors with an approach to grammar instruction that also resonates with math-based thinkers and engineering students who may desire explicit English grammar and/or language instruction. I wouldn't consider the volume a substitute for a more general technical communication textbook as the book lacks discussion of technical communication theory or rhetorical concerns. However, it could function as a helpful supplemental text for helping students, including multilingual students, who may find the explicit grammar-focused instruction helpful as they continue to develop as writers.

A Math-Based Writing System for Engineers provides a unique framework for how to think about language learning for math-based thinkers, particularly engineers. Henderson makes it clear from the beginning that the book's primary audience is meant to be engineering professionals rather than typical students in technical communication courses. It draws on mathematical language and framing to better reach the primary audience and help them understand "the structure and operation of the English language–its building blocks (words and sentences) and buildings (documents)" (p. 1). It is also important to note that Henderson does not recommend the text for teaching general technical communication to "aspiring professional technical writers" (p. 3). The clarification of the audience Henderson provides is essential because it assumes that the audience is interested and invested in learning more about the English language, particularly at the sentence level. It also means that the text cannot replace a typical technical communication/technical writing textbook for a course but may provide a helpful supplement for English language sentence-level instruction.

Henderson acknowledges that readers may choose to skip certain parts based on their experience and needs. The volume is divided into three sections. Part I (Chapters 2-8) is focused on what Henderson calls "sentence algebra" or defining the parts of speech using variables to create sentence equations and explain basic sentence structure. Part II (Chapters 9-13) discusses "sentence optimization" or how to simplify and clarify sentences and eliminate common errors. Part III (Chapters 14-21) defines what Henderson names "document algorithms," or five common genres of documents he believes engineers should know how to write. What makes Henderson's approach to language

instruction in the book unique is that it is math-based. In other words, Henderson frames the parts of speech and their functions by using algebraic equations and providing a function and variable for each part of speech.

In Part I, Henderson lays out the phenomenon described in the text as "spark." To create "spark," sentences are required to have a subject noun, using the variable (N), which must be joined together with a verb or the variable (V) to create meaning. This base equation is worth pointing out as it becomes the building block equation that the rest of Parts I and II are built upon. Over the course of several chapters, Henderson covers the purpose of each part of speech and how each one plays a role in various types of sentences. In many ways, if a reader is familiar with sentence diagramming, the coding system that Henderson lays out may feel very familiar. The difference is that Henderson frames the sentence diagramming as coding and decoding equations. For example, the sentence, "Sheila improved it." would be written in equation form as Ns + V + XO (Subject Noun + Verb + Object Pronoun). In addition to the equations and defining the various parts of speech as variables, Henderson uses matrices and flowcharts to demonstrate common sentence structures. This framework for thinking about how language functions within sentences is a different way of framing the material that may feel more comfortable for an audience accustomed to using equations and math-based vocabulary to talk about language.

Part II continues to build on the sentence algebra from Part I with a focus on making optimal sentences. The chapters address several topics that a reader may find in other technical communication texts such as clarity, passive vs. active voice, and parallelism. Although the approach is relatively prescriptive, it does likely align with the audience's expectations that Henderson outlines at the beginning of the text. Skill and drill "action items" are present at the end of all sections. Action items are meant to help the reader engage with the material they have just learned and include "thought tasks to further understanding of concepts and mini 'do' tasks to test drive application techniques" (p.3). At times, these exercises and examples seem disconnected from contextual writing the reader may be doing. However, other action items do engage readers in looking at their own personal writing in very specific ways to help them decode their own writing habits and determine if there are more effective ways they could be writing. The action items where writers are asked to engage with their own recent writing seem to be the most useful exercises throughout the text since the focus remains relevant and on an

authentic text rather than just individual sentences without context.

Part III of *A Math-Based Writing System for Engineers* is dedicated to what Henderson calls "document algorithms," or what technical communication instructors would consider common document genres or elements (such as tables and figures) that engineers are likely to use regularly in industry. Henderson focuses on five genres: project proposals, status reports, project reports, tech-to-non tech briefs, and instructional job aids. Henderson frames these genres in terms of "document algorithms," a move that "defines how the operative flow of a human language message develops and how and when the message's language stream articulates descriptions, claims, and evidence; and how these elements aggregate and synthesize into a coherent, cohesive, and convincing message output" (p. 211). Ultimately, Henderson hopes that the document algorithms take the "guesswork (and consequent anxiety)" out of creating these common workplace documents (p. 211). While there are excellent technical and professional communication textbooks that address these workplace documents, technical communication instructors will likely notice that while rhetorical concerns are briefly mentioned, the text spends little time on the topic. Again, this may have to do with Henderson's intended audience wanting the text to feel more practical and less theoretical.

Overall, the text takes a very practical approach to English grammar and language learning although it is one with which many technical communication instructors may feel ambivalent or uncomfortable. However, Parts I and II are still worth considering as supplemental material since some engineering students may find the text a useful way for understanding grammar concepts and sentence structure using a framework that they are more comfortable with. While Part III may provide some strong examples of common engineering documents, the lack of theory or rhetorical concerns in this section makes it less useful for discussions about genre in the technical communication classroom.

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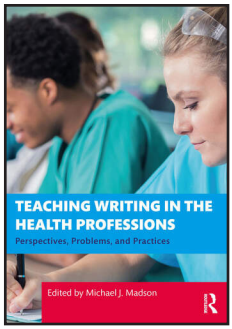

Teaching Writing in the Health Professions: Perspectives, Problems, and Practices

Michael J. Madson, Editor

New York

Routledge
2022. 203 pp.

Reviewed by Christina Michaud

Boston University

On the first page of the introduction to this volume, Michael J. Madson asserts that "health professionals need to learn a variety of written genres while in the classroom or on the job" (p. 1). His emphasis on genre is explicit and refreshing, and the genres highlighted are many and varied, both academic and practical. This introduction effectively sets the tone for the rest of the volume, first surveying the literature on writing instruction (or the lack thereof) in health professional education; next briefly nodding toward a writing across the curriculum (WAC) and writing in the disciplines (WID) framework; and finally approaching the entire subject of writing in the health professions from the point of view of interdisciplinary collaboration.

Contributors include faculty in English, linguistics, journalism, and technical communication, on one side, and medicine, nursing, and public health on the other. Emphasizing his contributors' diverse backgrounds, Madson positions this volume as part of an "ongoing dialogue to both deepen and broaden our instructional efforts"

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and to address writing in the health professions both practically/pedagogically and conceptually (p. 4).

Those two aims—practical and conceptual—help structure the collection. The first section addresses writing in medicine and public health, the second writing in nursing, the third writing in allied health and pharmacy, and the final writing in interpersonal contexts; Madson notes that he has generally arranged the chapters in each section "from lower to higher educational levels" (p. 5). This organization highlights one of the collection's strengths, which is an emphasis on writing in the health sciences across the professional career, from first- and second-year medical students to mid-career professionals.

The chapters in this volume address sub-topics as fascinating and as varied as writing prompts, writing workshops, reflective writing, peer review, revision, feedback, the socioemotional benefits of writing instruction, and writing-related threshold concepts. Among these, three key contrasts emerge, rising above smaller details. All three contrasts relate to what could be termed the primary theme of the collection, that is, writing as an important part of the process of socialization of health professionals into different discourse communities.

1. **Explicit vs. implicit instruction in writing**
   We know that students and health professionals write, and that their writing is evaluated, but how do students learn to write? Moving beyond the assign-and-assess model of writing into actual writing instruction is challenging. In a chapter titled "Teaching Medical Students to Write Proper Clinical Notes," Sarah Yonder discusses the importance of a tightly scaffolded approach to teaching medical students one particular genre. Deborah E. Tyndall, addressing "Writing-Related Threshold Concepts in Doctoral Nursing Education," criticizes the "trial-and-error types of instruction" that arise all too frequently (p. 92). And Isabell C. May and Emilie M. Ludeman argue for "the effectiveness of video podcasts," or digital mini-lectures with slides and narration, a type of "flipped" instruction, in writing instruction (p. 125). These three chapters, and many others, argue for—and, perhaps more importantly, also show readers how to structure—explicit instruction in writing, even when programs may feel that there is no space for writing instruction in their curriculum.

2. **Writing to learn vs. learning to write**
   If many of the contributors to this volume argue for explicit instruction in writing, they are then focused on a pedagogical approach that works with students who are learning to write specific genres for their particular fields. Nevertheless, the emphasis on reflective writing in this volume—and in the field of health sciences more generally, as advocated for by David Kember (2001) and more recently by Bruce H. Campbell (2020), among many others—suggests an alternate approach which importantly co-exists, that of writing to learn. Barbara J. D'Angelo and Barry M. Maid, in their chapter titled "Developing Students' Professional Identity through Writing and Peer Review," address this "writing to learn" approach and its connection to writing self-efficacy, arguing "that self-efficacy is increased when writing is used as a tool to enhance learning in the classroom" (p. 57). This emphasis on "writing to learn"—similar to explicit instruction in writing—moves beyond the assign-and-assess paradigm to view writing as a key component of a health professional program, neither a simple substitute for an exam, nor an add-on or frill, and therefore centers writing within students' professional training.

3. **Writing for self vs. writing for instructors**
   Given this centering of writing, all the contributors to this volume expect that students in the health professions will be writing for instructors, and many also address the role of writing that students will be doing for themselves. Such writing might include writing for whom the ultimate audience is the student's self (reflections, drafts, etc.) as well as writing with a more collaborative, emotional, and/or professional aim (see Lucy M. Candib, et al.'s, chapter "Promoting Writing Through Teacherless Writing Groups"). In both cases, though, the focus remains on writing as a skill that benefits the writer herself—as a student, and as a professional—across the health sciences.

Happily for programs looking to adopt an equity-based framework, *Teaching Writing in the Health Professions* has an inclusive approach to the subject and writers it addresses. There is a primarily North American focus to the collection, although a chapter by Elizabeth Narváez-Cardona and Pilar Mirely Chois-Lenis addresses writing and literacy instruction in Colombian health sciences graduate programs. Expanding this focus, the first chapter in the final section of the volume (titled "Teaching Culturally Sensitive Care Through Reflective

Writing" by Cristina Reyes Smith), explicitly situates itself within "the topics of diversity, culture, and inclusion" (p. 145) and provides a theoretical justification for the important inclusion of culturally sensitive approaches to health sciences writing tasks as well as specific examples of prompts used with students. Furthermore, a chapter titled "Supporting Medical Writers in the Twenty-First Century" by Rebecca Day Babcock et al. specifically situates itself within a World Englishes framework and addresses the concerns of writers and instructors when working within linguistically diverse populations comprising ESL speakers, multilingual writers, and transnational professionals. These three chapters explicitly anchor the implicit concerns of the entire volume, which Madson amplifies in his conclusion: "'Writing in the health professions,' as an emergent interdiscipline, needs broader coverage of the places where writing is done...[and] [f]uture studies should not be limited to the English language" (p. 193).

Ultimately, Madson's volume is a useful resource for program directors in the health professions, of course, but also for WAC or WID practitioners at the undergraduate level, interested in the kinds of writing that might trickle down to pre-professional programs, and for composition and rhetoric scholars especially interested in genre and in multimodality. In particular, the chapter by Kathryn West and Brian Callender on graphic medicine offers fascinating connections to writing studies approaches to teaching the creation and genre analysis of memes, infographics, and graphic memoirs.

Pre-med advisors and program directors, as well as general writing studies scholars working with undergraduates may also find this collection useful when considering the type and extent of writing instruction for undergraduates planning on careers in the health professions. "I don't really need to write much, because I'm pre-med," student after student tells me in my first-year writing seminars. Written in accessible, easy-to-read prose, this volume provides a strong counterargument to that assertion.

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