Board 432: Work in Progress: Assessing a Faculty Community of Practice and Identifying Its Opportunities to Enhance Equitable Infrastructure Education

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Dr. Rodolfo Valdes-Vasquez is an Associate Professor and Graduate Program Coordinator in the Department of Construction Management at Colorado State University. His research, teaching, and engagement align with sustainable design and construction topics. He has received grant funding from federal and state agencies and private organizations. Rodolfo has taught multiple courses at the undergraduate and graduate levels, and he is well-versed in the scholarship of teaching. His efforts in leading the Sustainable Buildings program were recognized with the 2019 Award for Excellence in Education Abroad Curriculum Design. He has also worked as a construction project engineer, consultant, and safety inspector. He believes educating the next generation of professionals will be pivotal in sustainability standard practices.

Regarding engagement, Dr. Valdes-Vasquez has served as the USGBC student club's adviser and the ASC Sustainability Team's faculty coach since 2013. He serves as a CSU President's Sustainability Commission member, among multiple other committees. In addition, he is involved with various professional organizations at the national level, including the American Society for Engineering Education (ASEE), the Associated School of Constructions (ASC), the Construction Research Congress (CRC), and the Center for Infrastructure Transformation and Education (CIT-E). At the international level, he serves as the Associate Editor for the ASC International Journal of Construction Education and Research. He collaborates with faculty members in Brazil, Costa Rica, Ecuador, Panama, and Spain.

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WIP - Assessing a Community of Practice and Identifying its Opportunities to Enhance Equitable Infrastructure Education

Abstract

The Center for Infrastructure Transformation and Education (CIT-E) is a community of faculty members who share a passion for infrastructure education. Their goal is to transform the way civil and environmental engineering (CEE) topics are taught. In 2021, the co-authors of this poster received an NSF IUSE grant to build the capacity of a faculty community of practice (CoP), positioning it to transform the approach to diversity, equity, inclusion, and justice (DEIJ) in CEE education. By incorporating DEIJ into their teaching, research, and service commitments, CEE faculty members can be the catalysts responsible for transitioning our nation's inequitable infrastructure into equitable infrastructure. This poster highlights three key assessment objectives, including a review of the literature on re-contextualizing infrastructure education, a SWOT analysis, and team science professional development.

Introduction

The CIT-E community of practice (CoP) is a group of faculty members who teach civil infrastructure-related courses at different institutions. Currently, the CoP is supported by a website and a model course on Canvas. The model course is composed of 43 lessons that are grouped into five categories: Fundamentals, Water, Energy, Transportation, and Capstone. In Spring 2021, a survey was conducted among the CIT-E CoP, which revealed that over 4,000 students have been impacted by the group, and that respondents are enthusiastic about improving their understanding of and pedagogical skills related to addressing issues that connect infrastructure and social justice in the classroom [1]. This project is a direct result of that survey, and our goal is to increase the capacity of the CIT-E CoP to transform infrastructure education.

In this paper, we focus on three key project activities that have been undertaken thus far: exploring successful efforts to re-contextualize infrastructure education, conducting a SWOT analysis of the CIT-E CoP, and utilizing team science principles to support both our individual and collective development. We provide an overview of each activity below and discuss our progress in subsequent sections.

First, an undergraduate research team has collaborated with the PIs to identify researchers and educators who have incorporated DEIJ aspects into their courses, curricula, and/or organizations. Additionally, the team is performing a systematic literature review and constructing a public bibliometric database of these resources using Zotero. The goal is to gain a better understanding of the DEI materials available in the engineering education field and their potential integration into the CIT-E educational models. Furthermore, the team seeks to understand how to effect significant change in engineering education.

Second, an external partner supported the execution of a SWOT analysis, which assessed the web infrastructure and produced a SWOT quadrant chart and recommendation report in three meetings. Beyond the NSF project team, faculty members were involved in the discussion and contributed their viewpoints on the SWOT quadrants. Analytics from both the website and Canvas will provide essential data to the CIT-E team, informing future design practices and evaluating current trends.

Third, we have engaged in two Team Science workshops, facilitated by an external partner. These workshops, in which we have documented and improved our communal procedures and practices, have helped us address some of the weaknesses identified in the SWOT analysis.

Current Progress

The following sections describe the project's progress in each of three areas as of early 2023.

Literature Review/Compilation of Successful DEI Efforts in Infrastructure Education

Our literature review has compiled a large number of publications in the area of DEI and engineering education. These publications cover a broad range of sub-topics, including analysis of data trends, calls to action, descriptions of best practices, opinion pieces, case studies, and appropriate and effective pedagogy. We found that some Civil and Environmental Engineering (CEE) faculty members and programs have re-introduced socio-technical context by teaching technical concepts in their real-world social and political context. Our systematic review of the published literature is ongoing.

While we continue to work on the larger set of articles, we have published a review of a subset of the literature focused on papers that discuss the implementation of interventions – that is, course or curricular changes that were actually made [2]. The preliminary search yielded more than 100 articles from 47 different sources, with about two-thirds of the sources being journals and just over a quarter being conference proceedings. However, approximately half of the articles are from journals and just under half are from conference proceedings. The most common source for work in this area is the IEEE Frontiers in Education Conference (FIE), followed by the ASEE Annual Conference, the IEEE Global Engineering Education Conference, and the American Society of Civil Engineers' Journal of Professional Issues in Engineering Education and Practice, which is now the Journal of Civil Engineering Education. A full list of these articles is available athttps://www.zotero.org/groups/4681078/cit-e_public. Almost half of these articles appeared in the proceedings of either FIE or the ASEE Annual Conference, and as with the full set of articles, about three quarters were published from 2017 to the present. This shows that there is a robust conversation happening about socio-technical issues in infrastructure education in at least two professional venues – the FIE and ASEE conferences.

We have coded a set of articles that address variations of sociotechnical context as the most common concepts. These articles commonly use case studies as a tool for contextualization and reflective practices for implementation. Engineering educators can use these articles as examples of implemented and assessed approaches. It is noteworthy that many of these efforts have been supported by grant funding, which suggests that external recognition and resources are crucial catalysts for change. Currently, we are expanding our study to include a broader set of articles up to 2022 publication dates. Our focus is specifically on efforts to address systemic racism. We are in the process of coding these articles and preparing an article that discusses the work.

SWOT Analysis Summary

On August 1, 2022, Virginia Tech Engineering Online (VTEO) conducted a SWOT analysis meeting for CIT-E with the goal of assessing the program's current status and future direction. Table 1 shows some of the key findings from the SWOT analysis.

Table 1. SWOT Analysis

Strengths	Weaknesses
• The willingness to share knowledge and try things that are different from the normal practices in the profession. • The available networking opportunities and learning collaborations. • The ability to geographically spread out. This led to online workshops that have increased reach and sustained working together. "There is a place for just about anyone here. We are not a specialty group."	• Canvas LMS - some accessibility issues, instructor facing only, not easy to find, housed at UW-Platteville rather than Commons, have not leveraged discussion forums. • Manual process of signing up new members (registration) – tedious • Difficulty finding the website. • High faculty workload. "I can see having a conversation with someone and say "Hey, we do this in Canvas" and they're like "Oh, I don't use Canvas. I can't engage."
Opportunities	**Threats**
• Exploring more Canvas features. • Updating the website/communication, thus leading to it being easier to find and more well designed. • Providing more open educational resources. • Hiring an instructional designer. "There is only one way to go and it's up!"	• People are busy - how to incentivize? • The potential scope is too large. • Organization is too dependent on a small group of people - not much for policies/procedures/rules/bylaws/terms • No succession planning! "We want to do everything."

The group agreed that the longevity of the Community of Practice (CoP) beyond the funding from NSF was a significant strength. Additionally, the increased utilization of online learning platforms in response to the COVID-19 pandemic was seen as a strength and an opportunity for the CoP to unify. It was also recognized that the CoP could greatly benefit from investing in cost-effective online infrastructure development, including search engine optimization, form automation, and instructional design support for web accessibility. An opportunity that this NSF Capacity Building grant is helping us to identify and better understand how our CoP operates, and to invest in the necessary online infrastructure to enhance our collaboration.

During the SWOT analysis meeting, several recommendations were generated, including:
- Expand search engine optimization to increase website traffic. This will help connect potential participants to the Canvas course, which is the primary way to engage with CIT-E.
- Update the website to enhance the overall user experience, accessibility, and design practices. Since the website is often a potential participant's first point of contact with CIT-E, it is crucial to create a positive impression.

- Hire an Instructional Designer to support the implementation of the recommendations above. Allocating funds for this role is necessary.
- Establish a Communication Protocol for the community of practice. Define rules, policies, and procedures for interacting in a human-centered approach.

We have hired a digital marketing agency that specializes in website design and social media, and content marketing to begin work on some of these recommendations.

Team Science Training

As interdisciplinary science continues to expand, scientists are increasingly working in larger and more diverse teams [3]. This particular team participated in the Teaming Readiness Survey, which evaluates a team's performance across key competencies. The survey feedback indicated that the team values the diversity of knowledge and experience among its members, with all members reporting that they learn from each other. Additionally, team members expressed feeling respected by their peers and energized by their conversations and teamwork, as well as by the project's topic.

The team identified specific skills they wished to improve during the grant period, ultimately selecting conflict resolution, communication, collaborative writing, and leadership as the core content for their team science workshops. Like many academic research teams, this team faces common challenges, such as balancing work on multiple projects, limited university infrastructure to support teams, and managing collaboration across different institutions. These challenges are not unique to this team, but rather are common among inter-university teams. To improve their team productivity, the team identified three areas in need of development: creating role clarity, addressing time conflicts, and establishing a clear list of team tasks and objectives. These actions will help the team better manage their workload and prioritize their efforts towards achieving their shared goals.

The team leading this project has participated in two Science of Team Science (SciTS) workshops conducted by the Institute for Research in the Social Sciences (IRISS). The purpose of attending these workshops was to learn about and practice principles of collaborative team leadership. Our goals are to improve our understanding of team dynamics, learn useful tools to apply during this project, and figure out how to use this new knowledge and skills in future work. The two workshops we attended focused on basic principles of Team Science and Managing an Effective Team. During the first workshop, we were given an overview of the field of SciTS, including the five domains of team science competencies [4]: 1) building genuine relationships, 2) team communication, 3) managing team research, 4) collaborative problem-solving and creativity, and 5) leadership.

Some of the key topics covered across the workshops included: a) expanding our ability to participate in a shared vision, b) understanding the importance of diversity and practicing using tools for inclusive teamwork, c) enhancing our awareness of developing shared language, d) exploring and practicing collaborative writing, e) drafting team charters, and f) developing guidelines for decision making.

We gathered several key takeaways from our workshop reflections:

- Being mindful of the value of team members when they are absent and reminding the group of their presence and importance.
- Trying out writing sprints, creating a team charter, and updating meeting agendas with "need to know" updates.
- Appreciating the turn-taking approach during meetings and implementing it more consciously.
- Ensuring inclusivity for new team members, especially undergraduate and graduate students.
- Discussing values and research approaches as a team.
- Utilizing the Start-Stop-Continue framework for giving feedback in various teams and situations.
- Focusing on role clarity in all team members.
- Recognizing the importance of building team trust by getting to know each other better.

Regarding the social network of the team, it has been discovered that there are two central individuals who have worked together in prior research and one additional collaborator. All members involved in this project have social connections with one another. It is anticipated that the relationships among team members will become even stronger over time and that the team will grow as the project progresses.

Future Work
Our primary goal for next year is to write a Level 2 proposal for the multi-institutional IUSE project. To achieve this, we will continue to work on the literature review, engage with additional Team Science Tools, and recruit other members based on the gaps identified during the SWOT analysis and meetings with project advisory board members. The results from the published literature review were preliminary. We are currently reviewing new articles and updating our coding structure to draw more profound conclusions, amplify existing efforts, and identify gaps. These gaps will be addressed as part of the CIT-E Canvas module and our upcoming workshops this year.

Furthermore, the results of the SWOT analysis demonstrate the progress of the CIT-E CoP. A plan to address weaknesses, threats, and opportunities will be included in the following grant proposal as we continue to build capacity for effecting change. Our next steps will be to engage the CIT-E community in discussions about the SWOT analysis findings and the program's future direction, as well as highlighting the program's accomplishments. Finally, the research team will participate in a final workshop on collaborative writing, team ideation, and best practices for grant writing. We will receive check-ins as needed and coaching on proposal development from IRISS. As the team grows, new members will be surveyed with the teaming readiness survey and included in the team's social network analysis.

Data Availability Statement
Please contact Dr. ABC at abc@abc.edu for access to the CIT-E Canvas model course if interested.

and the Lafayette College Excel Scholars program.

References

[1] K.L. Sanford, P.J. Parker, M.W. Roberts, C.M.D. Wilson, M.R. Penn, R. Valdes-Vasquez, and F. Paige, "Infrastructure Education in Unprecedented Times: Strengthening a Community of Practice," in Proc. of the American Society for Engineering Education 2021 Annual Conference, virtual, July 26-29, 2021.

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