

# *Building Common Ground: An Inter-Institutional Computing & Engineering Education Transfer Learning Community*

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**Abstract**—This experience report addresses one of five goals in a National Science Foundation project aligned to the research question: *How does the implementation of a collaborative, multi-institutional learning community of faculty, staff, and administrators change the perceptions, attitudes and knowledge about the transfer process in undergraduate computing and engineering education?* The transfer learning community (TLC) created to answer this question was composed of faculty and staff from a mid-sized research university and six partner community colleges. Over four years, members of the TLC participated in meetings and activities focused on articulation and curriculum alignment, cross-institutional advising, and interventions to support long-term, data-driven change to improve transfer student success, especially for women and underrepresented groups in undergraduate computing and engineering. Building common ground among faculty and staff across diverse computing and engineering departments at different institutions required time, trust, and intentional planning. Benefits of the TLC were particularly salient in the last project year (2019-20), when TLC leaders applied feedback from participants requesting more synergistic meetings and relevant activities and addressed shared concerns around transitioning to a fully remote educational model due to COVID-19 campus closures. Using data from surveys, interviews, and meeting transcripts, this paper will discuss lessons learned from this experience in the context of undergraduate computing and engineering education; how to use these lessons to support inclusive excellence in our post-pandemic higher education realities; and recommendations for adapting the TLC model for inter- and intra-institutional collaborations and partnerships for broadening successful transfer pathways in computing and engineering education.

**Keywords**—*adult education, community colleges, computer science education, computer engineering education, information systems education, transfer success*

## I. INTRODUCTION

Research on best practices for serving transfer students from community colleges, particularly underrepresented students in computing and engineering (C&E), highlights the need for better collaboration between two- and four-year institutions [1-4].

Such collaboration between community college and university personnel is absolutely critical to ensuring that transfer students intending to pursue computing and engineering degrees take the appropriate sequence of courses, build solid foundations in prerequisite technical skills, and are able to seamlessly transition into their chosen curriculum and graduate without delays. The Coronavirus Disease 2019 (COVID-19) pandemic has altered undergraduate education (including the aforementioned considerations for C&E students) in unprecedented ways with abrupt campus closures, unplanned transitions to online classes, and the provision of virtual student support services. Further, educators must attend to issues of access, bias, and inclusion in these emergency remote settings which could make women and underrepresented minority students even more vulnerable to academic marginalization [5-7]. This paper reports on the experience in one aspect of a National Science Foundation funded research project –an active, collaborative, multi-institutional, transfer learning community (TLC) structure between one public research university (UNIV) and six partner community colleges (CCs) designed to support long-term, data-driven, change to improve transfer student success, especially for women and underrepresented groups in computing and engineering. The longitudinal results of this effort are discussed with a focus on the galvanizing effect of COVID-19 in the Spring 2020 semester for faculty and staff in C&E fields across the two-and four-year transfer pathway.

## A. Background

Interinstitutional partnerships that promote the transfer of community college students to four-year institutions help facilitate moving the transfer process beyond articulation towards a more successful and integrated pathway. The strength of these partnerships depends on active and dynamic collaboration [1-4]. The effectiveness of these partnerships depends on a willingness to make the kinds of institutional changes that best meet the needs of a diverse group of students. We assessed our community of practice based on the value it generated for the participants at both institutional settings and the convergence of that value. Wenger-Trayner et al. [8] provide five dimensions of value against which a community or network

can be evaluated by exploring five cycles of development. The five types of value created by communities of practice are:

**Cycle 1.** Immediate value: the activities and interactions between members have value in and of themselves

**Cycle 2.** Potential value: the activities and interactions of cycle 1 may not be realized immediately, but rather be saved up as knowledge capital whose value is in its potential to be realized later.

**Cycle 3.** Applied value: knowledge capital may or may not be put into use. Leveraging capital requires adapting and applying it to a specific situation.

**Cycle 4.** Realized value: even applied new practices or tools are not enough. A change in practice does not necessarily lead to improved performance, so it is important to find out what effects the application of knowledge capital is having on the achievement of what matters to stakeholders.

**Cycle 5.** Reframing value: this happens when learning causes a reconsideration of how success is defined. It includes reframing strategies, goals and values.

In the era of COVID-19, value convergence among TLC participants, and faculty and staff across two- and four-year institutions generally, is especially necessary. Many four-year colleges and universities are online in the 2020-21 academic year and some families see community college as a safer and cheaper option for their students' schooling [9]. In Fall 2021, community colleges will be receiving new students, continuing students, a probable influx of four-year students (who intend to return to their institutions), as well as a potential surge in adult learners as many unemployed workers may seek training for job advancement when the economy improves [10].

### *B. Purpose*

The experience of focus in this paper is the development and implementation of an active, collaborative, multi-institutional, transfer learning community (TLC) structure to support long-term, data-driven change to improve transfer student success, especially for women and underrepresented groups in computing and engineering. The driving research question was: How does the implementation of a collaborative, multi-institutional learning community of C&E faculty, staff, and administrators change the perceptions, attitudes and knowledge about the transfer process in undergraduate C&E education?

### *C. Anticipated Outcomes*

We anticipated that the project would result in the institutionalization of a robust, active learning community focused on understanding and improving transfer success. A total of at least 25 representatives from UNIV and its six partner community colleges would be included in the TLC. Each institution would have at least one faculty member from computing and engineering as well as one academic advisor community would be held once per semester. A model would be developed that could be utilized by other institutions in the development of two-year and four-year learning communities in these disciplines. We anticipated increases in knowledge about the specific issues and best practices for serving transfer students in these majors as well as areas needing improvement

at the participant's institutions with the aim of creating long-term, data-driven, change to improve transfer student success, especially for women and underrepresented groups in computing and engineering.

## II. IMPLEMENTATION

This experience is based on a longitudinal educational design and development research project. Participants met twice per year for in-person meetings of the TLC, except for the Spring 2020 semester which was hosted virtually due to COVID-19. We employ pre- and post-surveys as a primary method of data collection. Additional data sources include minutes of the TLC meetings, as well as interviews with members of the TLC.

### *A. Experience Context & Methods*

The TLC meetings took place at a mid-sized, public research university (UNIV). The sample included faculty in C&E departments and advising staff (N=20) from six partner community colleges and faculty in C&E departments, advising staff, and project team members (N=8) from the lead university. Short surveys were administered after each TLC meeting to capture participant satisfaction with the meeting, potential next steps which were used to plan subsequent meeting agendas, and impact of the project to date. In the first year of the grant, surveys were collected electronically a week after the meeting, however, a switch to a paper-based survey administered in the final minutes of the meeting proved to secure a stronger response rate. Email invitations were sent to non-respondents (or those who left early) with data collection open for one week after the meeting. In year three of the project individual phone interviews were held with members of the TLC from both UNIV and CCs to better understand motivation for participation, benefits of participation and the strengths and limitations of the TLC model.

## III. IMPACT

Participant feedback indicates that, initially, TLC attendance and engagement were inconsistent, potentially because of the impression among some members that this project was more beneficial to UNIV than CCs. The TLC faced struggles with politics and prejudices of the UNIV towards CCs in the context of perceived lower competence of transfer students and rigor of instruction at the CCs. The CC members also noted that some of the challenges associated with transfer success were largely structural (for example the funding formula used by the state to support UNIV and CCs or the lack of alignment between the UNIV system) and were beyond the influence of the TLC. These conflicts made it sometimes difficult to achieve buy-in across TLC members and presented challenges to our collaborative work. When the model of meetings shifted to focus more on mutually beneficial and achievable outcomes, as opposed to presentations from UNIV faculty and staff, there was increased participation, more positive feedback, and more consistent and involved responses to email communication.

During the 2019-2020 academic year, the TLC faculty and staff began to find common ground and address shared goals and challenges in their classrooms and beyond. Nineteen faculty and

staff members attended our in-person November 2019 TLC meeting and 17 attended our virtual April 2020 meeting. The Fall 2019 meeting included collaborative work between members of computing and engineering departments from all institutions to discuss the benefits of the transfer seminar (TRS) courses, another aspect of the grant project focused on supporting the academic and social integration of transfer students in C&E departments. Participants reviewed the syllabi for the TRS courses together and shared feedback on any curricular adjustments that would benefit transfer students in these majors. The Spring 2020 meeting was focused on the challenges, experiences, and strategies for faculty and students as they transition to a fully online educational model following campus closures due to the COVID-19 pandemic. This meeting was particularly successful, despite having to meet virtually.

Faculty and staff sought solutions to a variety of shared concerns including: identifying and responding to student needs, varied student access to the internet and time constraints, managing online classroom culture, online test administration, online labs and studio classes, monitoring group projects, funding for technical equipment, and more. Additionally, the Spring 2020 meeting was the first time we had transfer students representing some of the community colleges of faculty and staff in attendance. Student attendees discussed that they experienced difficulties connecting with peers and instructors and were navigating distractions and stressors at many levels (e.g., family life, inconsistent internet and routine, no computer, no camera, minimal data on smartphone, financial stress, health issues, etc.). As none of the partner institutions were primarily implementing distance learning prior to COVID-19, students, faculty, and staff alike were all coping with increased demands for training and adaptation to a new remote work environment, in addition to the effects of this transition on their personal lives.

Through the lens of the Wenger-Trayner et al. framework, and based on faculty and staff participant responses, we can see that each meeting in the 2019-20 academic year consistently provided immediate value and potential value [8]. The meetings were well run, relevant to participants' responsibilities, and facilitated engagement. In post-meeting surveys, participants reported making new connections, feeling well prepared to support students, and able to identify the challenges and opportunities for improvement related to the transfer process. One participant noted that, "Receiving up-to-date information about the transfer process and curriculum directly from the faculty and staff at UNIV that are involved and control these areas" was an important benefit the group provides.

Post-meeting survey responses from both fall 2019 and spring 2020 suggest that the TLC may also have some applied value. In the fall, participants agreed that the group was able to determine a set of next steps that could help the learning community move forward. Specifically, the respondents identified addressing advising through collaboration between community college advisors and faculty members and with UNIV advisors as important for maintaining momentum. Curricular issues continued to be an important issue, including the TRS course specifically, and course content alignment and expectations (e.g., which programming language is preferred for Computer Science I & II). In the spring responses, participants emphasized policies related to transfer and resources,

particularly during this time of distance-learning. One participant reported that through the TLC, "I can provide more precise and current information to students and help them make more informed choices.", which further adds to the applied value of the TLC.

By the end of the 2019/2020 school year, participants from both UNIV and the CCs were also beginning to appreciate the value of the community. When asked what the most important benefits to the institution are, CC participants reported that they have developed a better understanding of the transfer process and that the partnership will help connect students to resources and opportunities. One participant wrote "It has been very helpful to know about requirements, campus resources, curriculum and policies." while another commented that "receiving up-to-date information about the transfer process and curriculum directly from the faculty and staff at UNIV that are involved and control these areas" has been an important benefit. The UNIV participants gained greater awareness of the policies of each CC and one UNIV representative noted the value of "direct and regular connections to community college peers." In this last statement, the use of the word "peer" should not be underestimated as an indicator of community and respect that grew in the TLC, compared to the language used early in the project that reflected an "us" vs. "them" attitude.

As the community evolved, the participants reported dramatic increases in the value of the meetings. Table 1 compares the responses between Spring 2017, Fall 2019 and Spring 2020 for which there was a change of at least .3 points. The slight drop in values for Spring 2020 may be a result of the low response rate and/or the cognitive load the COVID-19 pandemic has demanded. Promising, however, is the participants' steadily increasing appreciation of what can be done to improve the transfer process, which provides opportunity for further collaboration in the post-pandemic C&E education context.

TABLE 1. *Changes in participant perception of the TLC over time.*

To what extent do you agree with the following items: *	SP17 (N=18)	FA19 (N=15)	SP20 (N=5)
I networked with individuals who can influence the transfer process.	3.8	4.4	4.2
I am more prepared to support students in the transfer process.	3.9	4.4	4.2
I made new connections with people who can help me improve the transfer process at my school.	3.7	4.4	4.0
I have a better appreciation of what can be done to improve the transfer process.	3.8	4.1	4.6

\*Response scale = (1) Disagree Strongly to (5) Agree Strongly

#### IV. DISCUSSION

This experience is significant because it established a novel infrastructure for a learning community to improve transfer rates and increase retention and graduation rates of community

college students in computing and engineering disciplines. The project also advanced a model for cross-disciplinary and cross-institutional collaborations between departments, institutions, and faculty and staff, to improve success, retention, and diversity of transfer students from community colleges. The TLC has highlighted exciting opportunities for changes in policy and practice surrounding computer and engineering transfer student success at UNIV and beyond. For example, UNIV faculty and staff are more connected to faculty and staff at partner institutions, providing easier access to discussions for purposeful and mutually beneficial course alignment with feeder community colleges. Additionally, this process has elucidated the reciprocal needs and mutual benefits of the relationship between UNIV and CCs, and the creation of common ground through team-based course and syllabus reviews.

The connections made through the TLC have helped to build department level relationships between faculty at the partner community colleges and the undergraduate program directors within the C&E academic departments at UNIV. Though the value of this learning community experience has been centered on the first three stages of the Wenger-Trayner et al. framework [8] (immediate value, potential value, and applied value), as this work continues, there is still opportunity for us to observe its realized value and reframing value among participants. Specifically, we'd like to see that the application of this knowledge capital around transfer success in C&E is affecting the performance and achievement of our faculty and staff stakeholders, both at the community college and UNIV settings. Additionally, we'd like to understand how this experience has caused stakeholders to reconsider how transfer success is defined and informed any shifts in strategies, goals and values at the department level. Beyond this project, which is in its final year, the TLC work will continue at the department level and the faculty and staff on this project will serve as liaisons and support that transition. We are encouraged that many of the interventions piloted through this project are in plans to be institutionalized and that the investment from the National Science Foundation yielded a successful program model for developing best practices and supporting transfer success across pathways from community college to university.

#### A. Adapting the Model

Based on our observations and analysis of the TLC participant experience, we recommend the following practices for future adaptations of the TLC, as well as inter- and intra-institutional collaborations and partnerships in support of successful transfer pathways in undergraduate C&E programs:

- From the inception of the partnership, consult faculty and staff members of the TLC for input on potential topics and priorities to be addressed throughout the collaboration. Establishing a shared sense of benefit and contribution up front can help create value convergence among members early on.
- Consider institutional and departmental priorities and use the shared community space to advance the goals of the academic programs. For example, one academic department may be facing enrollment pressure and seeking strategies to streamline the size of incoming cohorts, while another department may have depressed enrollments and a

desire to work creatively to increase their incoming cohorts to maintain their resources (faculty, staff, space).

- Design community meetings and activities around topics that are timely, relevant, and practical in order to sustain long-term engagement and perceived value of the community of practice. In the current context of higher education and COVID-19, such topics might include strategies for how to teach particular C&E courses successfully in an online format (given variability in tools and resources across institutions), and how to cultivate a supportive and inclusive online classroom environment.
- Develop an online space to share resources, publish announcements, and foster engagement outside of meetings. The norms around the use and maintenance of this space should be integrated into the TLC from the beginning of the process. Some platforms such as Google (Sites) offer comprehensive options, but require front-end work to connect everyone, especially those who don't have an existing account to access the platform.

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