Mentor Perspectives of Apprenticeships for Community College STEM Careers

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Abstract

The National Science Foundation's Eddie Bernice Johnson INCLUDES Aspire Alliance has established several RC (Regional Change) Collaboratives of two-year and four-year higher education institutions, focused on preparing a diverse and inclusive future community college faculty. Each RC collaborative recruits graduate students enrolled at research-intensive or comprehensive universities to participate in semester-long apprenticeships under the mentorship of community college professors. In Texas, two of these RC collaboratives have been operating continuously since 2019 with the participation of institutions that serve diverse student populations from urban and rural regions and are advocates of organizational change that impacts their ecosystem and fosters equity. Both RC collaboratives have implemented their own successful apprenticeships adapted to regional needs. In recent work, we described one of these RC collaboratives, shared its emerging mentoring model, and discussed the significance of assessment data gathered through end-of-apprenticeship surveys. In this paper, we provide and conduct a comparative analysis of the work conducted at both RC collaboratives. We also provide demographic data of STEM (Science, Technology, Engineering, or Mathematics) faculty from the partnering community colleges and compare ethnicity/race rates to those of community college students and state-wide population. In addition, we provide the perspectives of faculty mentors collected via surveys that probe into the merits and challenges of apprenticeships. The mentors' survey responses indicate that they are supportive of sustaining the efforts of the two regional collaboratives.

I. Introduction

Since the inception of the National Science Foundation's Eddie Bernice Johnson INCLUDES Aspire Alliance in 2018, its leaders have worked with faculty, future faculty, and faculty influencers in a shared leadership model to advance broadening participation in Science, Technology, Engineering, and Mathematics (STEM). The ultimate vision of the Alliance is to have an inclusive and diverse STEM faculty who can thrive within inclusive organizations. To realize its vision, the Alliance has organized research and implementation teams around three main initiatives: Institutional Change, National Change, and Regional Change. Each initiative implements strategies for systemic change that are designed to improve awareness, learning, skills, practices/policies, and a culture of change to achieve the alliance's broadening participation outcomes [ASPIRE, 2023].

The Regional Change (RC) team has implemented (6) collaboratives, which are networks of geographically related (21) two and (17) four-year institutions, that work together to share and develop programs and experiences that work towards two primary goals: to foster the

engagement of four-year institutions and partnering two-year institutions for the purpose of creating a diversified and well-prepared pool of future STEM faculty; and to develop programs that will allow graduate STEM students to explore the possibility of a rewarding career at two-year institutions through meaningful and intensive mentoring relationships.

In Texas, four public state universities and six community colleges have organized into two separate RC collaboratives with the goal of engaging graduate students who have expressed interest in exploring academic careers at community colleges. The universities and partnering community colleges have strong ties with the commitment to serve their region by providing educational opportunities to first-generation college students. These impactful opportunities translate into degree and employment attainment, continued professional development, and upward social mobility for university graduates with STEM master's degrees.

The Texas RC collaboratives serve different geographical regions with distinct demographics. The West Texas region comprises two urban areas with a Hispanic majority population. The North Texas region comprises an urban area with multi-racial and multi-ethnic representation. A third region, East Texas, is a partly urban area with a Non-Hispanic White majority population. The West Texas region is served by a collaborative of six institutions, two universities, and four community colleges. The North and East Texas regions are served by a collaborative of four institutions, two universities, and two community colleges. Both RC collaboratives share a vision that aims to foster the growth of inclusive STEM future faculty, further details on the vision of the collaboratives can be found in our previous publications [1],[2].

The Texas RC collaboratives recognize that graduate students are at an ideal career stage to design their professional pathways based on their positionality, especially for junior/ community colleges and regional universities. An emphasis on the versatility of graduate degrees allows students to explore their professional development to become inclusive STEM future faculty [3]. This recognition results from newfound interest among graduate students in future academic careers [NSF, 2021]. Along with the versatility of degrees opening industry and research positions for graduate students, it is also crucial for them to participate in an experiential learning experience in preparation for a potential career as future faculty.

Paired with the developmental activities, the Texas RC collaboratives have utilized meaningful and intensive mentoring as an effective strategy to prepare graduate students for future faculty careers [1]. Mentoring has been widely recognized as a crucial factor in creating successful future faculty out of the nation's graduate student population. The Texas RCs have also observed evidence of the above because of conducting mentored practicums for participating graduate students [4]. Previous dissemination efforts have addressed the perspectives of participating students as well as the alliance's sustained network of evidence-based practices. Detailed results along with feedback and opinions of the faculty mentors involved will be discussed in detail as follows.

II. Making a Case for Diversification of Community College Faculty in Texas

According to the Texas Association of Community Colleges, which advocates for a shared common voiced and focused strategy, community colleges in the state to "change lives through social and economic mobility; value transformational change, transformational thinking, and transformational leadership; and envision a thriving, forward-looking Texas where all students have an opportunity for education beyond high school." [TACC, 2022] Implicit in this statement is a commitment to access affordable higher education, which is an attractive proposition for first-generation college students from diverse backgrounds. Mission-aligned strategies such as articulation agreements and common course designations ease the transfer processes of students to public universities. Academic pathways to a baccalaureate degree are well-known and widely supported in STEM areas across institutions but career preparedness for these fields is also in need of attention.

As reported by the US Census Bureau, 2022 estimates of Texas' population included a 40.2% Hispanic and a 13.2% Black or African American representation. In comparison, the community college student demographics of the Texas RC participating institutions, as shown in Table 1, indicate that Hispanic Americans are overrepresented by 52% and African Americans are underrepresented by 10%. The overrepresentation of Hispanic students in this group of 2-year colleges is mainly attributed to consistent high enrollment trends of this group in West Texas colleges, particularly at institutions located in Hispanic-majority settings. In contrast, African American students are largely underrepresented across West Texas institutions but continue to have significant representation at North and East Texas institutions.

College	Region	Students	Race/Ethnicity	
			Hispanic American	African American or Black
El Paso CC	West Texas	26,034	86%	2%
Howard College		3,674	49%	5%
Midland College		4,737	50%	6%
Odessa College		7,019	62%	5%
Tarrant County CC	North Texas	43,000	34%	16%
Tyler Junior College	East Texas	11,749	26%	16%
TOTAL		96,213	52%	10%

Table 1. Community college student demographics for Texas RC Collaboratives (Fall 2022)

A similar pattern is observed for STEM faculty demographics in the Texas RC collaboratives. As shown in Table 2, Hispanic faculty are overrepresented in West Texas and underrepresented in North and East Texas with respect to state population rates. It should be noted that a substantial number of Hispanic faculty serve at an institution located in a Hispanic-majority city. Post-pandemic, the overall rate of Hispanic faculty in the two RC collaboratives is proportional to the Hispanic population in Texas. In contrast, African American faculty are significantly underrepresented in West Texas and underrepresented in North and East Texas. Overall, the number of African American faculty reached a peak in 2021. The gap to a more proportional representation continues to be significant.

Year	Race/ Ethnicity	El Paso	Howard	Midland	Odessa	Subtotal	Tarrant	Tyler	Subtotal	Total
2018	All	122	7	24	17	170	33	49	82	252
	Hispanic	103	2	7	3	115	5	5	10	125 49.6%
	African American	0	0	0	0	0	2	3	5	5 2.0%
2019	All	115	6	14	16	151	74	68	142	293
	Hispanic	96	2	7	4	109	9	6	15	124 42.3%
	African American	0	0	0	1	1	8	5	13	14 4.8%
2020	All	95	6	16	23	112	111	78	189	301
	Hispanic	78	2	9	6	95	16	7	23	118 39.2%
	African American	0	0	0	2	2	14	10	24	26 8.6%
2021	All	107	7	28	32	174	102	82	184	358
	Hispanic	91	2	17	10	120	17	4	21	141 39.4%
	African American	0	0	2	3	5	13	3	16	21 5.9%

Table 2. STEM Faculty demographics for participating community colleges by institution and aggregated by region (West, North/East Texas). Source: IPEDS Data Explorer Tool [NCES, 2022].

Between 2018 and 2021, the number of community college STEM faculty positions was in a state of flux. In West Texas, the number of faculty positions reached a low in 2020 but recovered by 2021. This is parallel to enrollment challenges posited during the pandemic [6]. In contrast, in

North and East Texas the number of STEM faculty positions has continued to increase consistently and at a considerable rate. Overall, the number of STEM faculty positions in participating institutions from the Texas RC collaborative, have increased over the period reported.

III. Describing Regional Collaborative Mentorship Models

As explained above, the Texas RC collaboratives are distributed in three distinct regions of the state. Previous papers have focused primarily on work conducted in the West Texas Region [1-2],[5],[8-10]. Here we aim to provide a comparative overview of both Texas RC collaboratives along with corresponding mentor perspectives. Both RC collaboratives rely heavily on dedicated faculty from the partnering community colleges to provide mentorship. Both RC collaboratives conducted a semester-long Mentoring Teaching Practicum (MTP) but differed in their execution modalities. Previous work has addressed the evolution and adjustments of these mentoring models [7].

The collaboratives that operate in North and East Texas recruit STEM graduate students previously identified by the faculty to participate in workshop sessions on faculty careers at community colleges. These workshops respond to the need for professional development of graduate students pertaining to potential faculty career paths. The workshops also provide participating students with a career reflection from a community college faculty and a panel discussion regarding aspects of faculty responsibilities, student populations, and the overall environment at community colleges.

At the end of the workshop, prospective students are asked to sign up for a follow-up experience. A select number of students who participated in the workshop are paired with faculty mentors for classroom observation visits. The mentors provide support by scheduling meetings before and after the observations along with adequate resources and checklists to complete the activity. An internal survey is then conducted for the mentors and students to assess their willingness to participate in the third set of activities. Interested students are then recruited to participate in the next semester for a mentored teaching practicum. The students are offered a fellowship where they are required to teach a module of course content that has been selected in consultation with the mentor-teacher. Meetings are scheduled between the mentors and fellows throughout the semester to provide adequate help and guidance. At the end of the experience, fellows are required to submit a reflective essay and list the fellowship on their curriculum vitae. All final mentors and fellows are required to complete a survey conducted by an external evaluator. It should be noted that this survey is conducted for all RC collaboratives.

The activities of the collaborative that operates in West Texas along with its participating institutions have been discussed in previous work [1-2]. As the program evolved, the collaborative made multiple modifications to the mentoring models and to the execution of the activities to serve the needs of the graduate students more effectively. More recently, graduate

students aspiring to become future faculty are invited to an information webinar co-hosted with the efforts of the respective graduate schools. These informative sessions are open to all graduate students in STEM fields and are promoted via campus announcements and by direct emails to graduate program directors. These sessions broadly discuss the mission and foci of 2-year institutions, faculty responsibilities, and practicum expectations, while informing them about the prospects of future careers in community colleges. Interested students are then invited to apply for a fellowship experience. Aspiring students complete an online application, and a selection committee forms the participating cohort from this applicant pool. Fellows are formally inducted into the practicum experience. This provides a semester of professional development webinars, classroom observations, and workshops. Notable topics include the importance of professional networking; CC faculty responsibilities; as well as diversity, equity, and inclusion in teaching practices. Fellows also participate in workshops to prepare inclusive teaching philosophies and learn to create lesson plans that are aligned with the mission of their institution and in compliance with the curricular or subject plans. The deliverables are submitted for review and feedback from the faculty mentors and the Aspire lead team. At the end of the semester, fellows submit a teaching portfolio as evidence of completion and participate in a closing ceremony in which the fellows and their mentors are recognized.

IV. Similarities and Differences between RC Collaborative models

Similarities:

Each of the two Texas RC collaboratives includes two universities; one of them is a large research-intensive in an urban setting while the other is a comprehensive university in a semi-urban setting. Both RC collaboratives started activities in person in 2019 but had to switch to an online model due to the COVID-19 pandemic in 2020 [6]. Both RC collaboratives have the support from community college faculty who serve as mentors to graduate students and participate in professional development webinars to shape prospective future faculty. Both RC collaboratives facilitate classroom observations while providing additional resources allowing students to get first-hand exposure to community college teaching, student populations, and the classroom environment.

Differences:

Since it began operation in 2019 the RC collaborative serving North and East Texas has utilized a triad mentoring approach involving a university professor, a community college professor, and a master's or doctoral student. In contrast, the RC collaborative serving West Texas modified its mentoring model from a triad approach to a dyad approach to a group mentoring model. One RC collaborative conducted the classroom observations in the fall semester prior to the teaching practicum experience in the following spring. It also developed a tiered experience such that all students participate in observations but only a select cohort may participate in the practicum. The other RC collaborative offers awareness webinars in the fall semester and selects a cohort of students to participate in a spring program that links classroom observation to deliverables as an

integral part of the teaching practicum. Although both RC collaboratives are members of the National Center for Integration of Research, Teaching, and Learning network [CIRTL, 2023], only the North and East Texas collaborative utilizes online professional development resources to offer graduate students a professional development curriculum with emphasis on evidence-based effective teaching. In contrast, the collaborative in West Texas refined its own set of evidence-based professional development webinars and related resources to emphasize inclusive teaching and developed an extensive resource bank for its fellows. RC fellows in North and East Texas have the opportunity to teach one module of a course at a community college under the guidance of their mentor. Subsequently, the fellows discuss and reflect upon their experience in a final essay. RC fellows in West Texas cannot teach academic modules due to institutional policy, but they instead create an inclusive teaching philosophy statement, design a lesson plan, and create a final teaching portfolio for future interviews.

V. Methods

Following a retrospective pretest model [8], evaluation data were collected from respondents - both graduate students who participated in a teaching practicum (mentees) and their community college faculty mentors. The Aspire Alliance Evaluation team (named in the acknowledgments) shared an online survey link with all mentees and mentors via Qualtrics immediately after participating in the Aspire Regional Change mentored teaching practicum. Generally, the survey fielding period lasted 2 weeks with multiple email reminders sent. This paper focuses on reporting on survey responses from mentors only and for implementations following the pandemic (2020-2021, and 2021-2022).

Survey instruments contained Likert-scale items, open-ended survey items, and demographic questions. Mentors were asked to respond to four sets of retrospective pre-post questions. Mentors were asked to rate: 1) their mentee's knowledge of community colleges before and after the teaching practicum, 2) their mentee's skills for equitable and inclusive community college instruction, and 3) their mentee's commitment to the mentored teaching practicum (MTP) experience, and 4) their mentee's interest in teaching at a community college, and 5) their mentee's readiness to teach at a community college. These questions were measured using a 6-point Likert scale (ranging from 1 = not at all to 6 = extremely). This subset of questions in the mentor survey instrument focus on the mentee's command of key skills and they parallel to survey items where mentees self-assess on the same skills, thus facilitating direct comparison between mentee and mentor perceptions of mentee skills (paper under review).

An additional block of Likert-scale survey items asked community college faculty mentors to reflect on their own commitment to the MTP. Mentors were asked to report on the extent to which they: (a) are committed to the MTP, (b) would recommend involvement to a colleague, (c) would like to continue being involved, and (d) found their involvement worthwhile. Together these items speak to the community college mentors' satisfaction with and sense of value

emerging from their involvement in the MTP. We see these items as meaningful indicators of whether these partnerships are continuing to be rewarding for the community college mentors, and whether they are impactful for their mentees. Lastly, a few open-ended questions on this survey included: (a) “How did participating in the mentored teaching fellowship influence your career interests and development?” and (b) “What aspect of the mentored teaching fellowship was most useful to you as a mentor, and why?”

During the 2020-2021 academic year, all active faculty mentors in RC were asked to take a post-survey following the teaching practicum implementation. Eighteen mentors took this survey, the vast majority of whom were from the Texas RC Collaboratives (14 mentor responses from across the two Texas RC collaboratives). Additionally, during the 2021-2022 academic year, all active faculty mentors in RC were asked to take a post-survey following the teaching practicum implementation. Sixteen mentors took this survey, and many respondents were from the Texas RC collaboratives (9 mentor responses from across the two Texas RC collaboratives). Here, we report on aggregated data using the full set of 18 mentors from 2020-2021 and aggregated data using the full set of 16 mentors from 2021-2022. For our 2021 mentor survey, 18 out of 41 mentors responded to some survey questions for a 44% response rate. For our 2022 mentor survey, 19 out of 40 mentors responded to some survey questions with a 48% response rate. All survey questions were optional; therefore, some individual question response rates may vary. Our evaluation team has found that trends in survey results are similar across RCs, and we, therefore, choose to present aggregated results here.

VI. Community College Faculty Mentors’ Perspectives on RC Collaboratives

Evaluation data suggests that our community college faculty **mentors are highly committed to mentoring fellows**. Many Texas RC faculty mentors return year after year to contribute to mentoring additional cohorts of fellows. In our 2020-2021 surveys, mentors report high levels of personal commitment to their mentees’ teaching practicum experience. For example, mentors rated themselves as 'very committed' (5.28 on a 6-point scale) to the MTP. This result was repeated in the following 2021-2022 academic year, where mentors continued to rate themselves as 'very committed' (5.75 on a 6-point scale) to the MTP.

Community college faculty mentors are invested in the long-term continuation of these activities. Mentors report their personal desire to continue their involvement and they recommend that their colleagues get involved in these mentoring activities. In our 2021-2022 surveys (N=16), mentors report that they are very enthusiastic about continuing their involvement (with 6% indicating moderately committed, 19% indicating very committed, and 75% indicating extremely committed). In our 2021-2022 surveys (N=16), mentors report that they would very highly or enthusiastically recommend that their colleagues get involved in these activities (with 31% indicating very highly, and 69% indicating extremely). In our 2021-2022 surveys (N=16), mentors report that their involvement is worthwhile (with 31% indicating very

highly, and 69% indicating extremely). These indicators suggest that these partnerships are continuing to be rewarding for participating community college mentors and have the potential to prove rewarding for future mentors who may wish to be involved in similar programs.

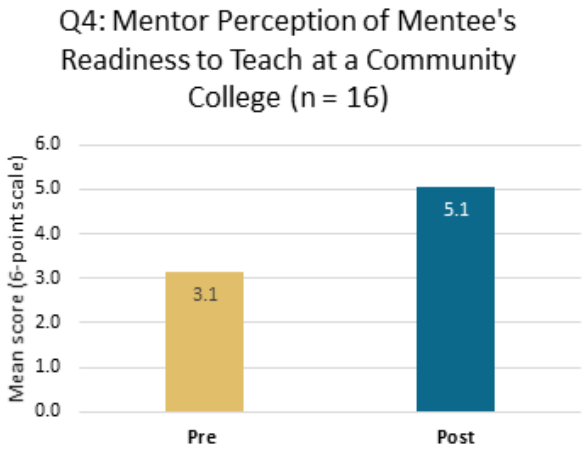

Figure 1: Mentors' perceptions of their mentees' pre and post readiness to teach at a community college (based on survey responses from mentors in 2021-2022)

Mentors recognize mentees committed to the MTP experience. In our 2020-2021 surveys, mentors report that their mentees were on average committed to their teaching practicum experience, rating their mentees as 'committed' (4.89 on a 6-point scale). In our 2021-2022 surveys, mentors report that their mentees were on average committed to their MTP experience, rating their mentees as 'very committed' (5.43 on a 6-point scale).

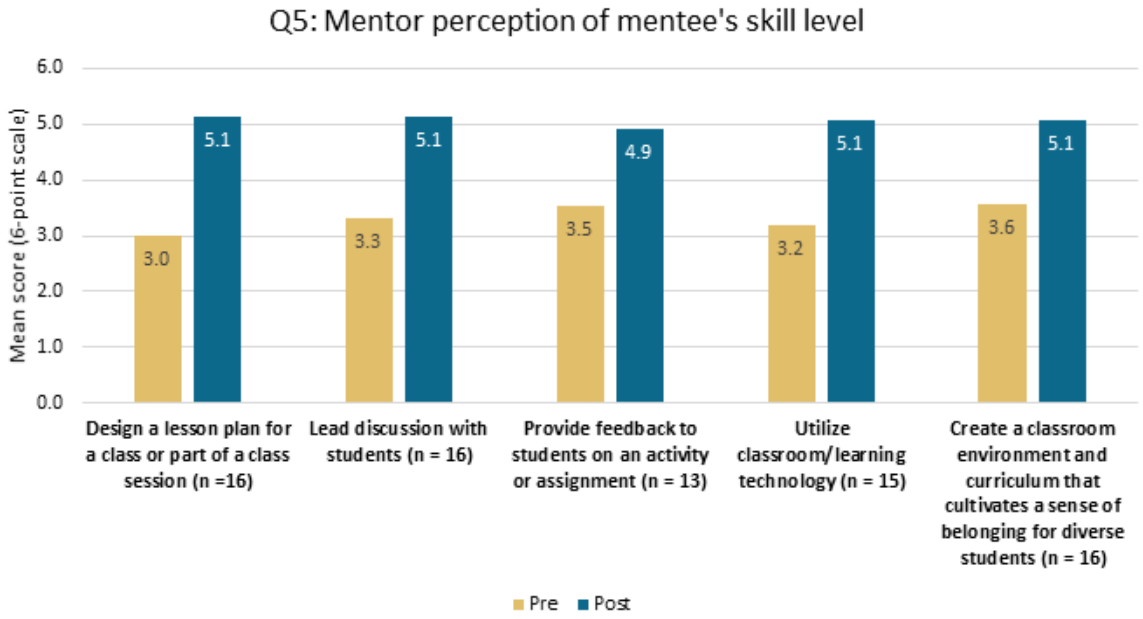

Figure 2: Mentors' perceptions of their mentees' pre and post skill level relative to specific teaching skills (based on survey responses from mentors in 2021-2022)

Mentors recognize valuable impacts resulting from their mentees' MTP experience. In our 2020-2021 surveys, mentors found that the MTP was very valuable to their mentee's professional development in terms of helping them learn about community colleges (5.06 on a 6-point scale) and learning through observing their mentors' teaching (4.65 on a 6-point scale) (*Note: This 6-point Likert scale ranged from 1) not at all to 6) Extremely*). On retrospective pre-post items in the 2021-2022 survey, mentors reported substantial shifts in their mentees' teaching skills and their readiness to teach within community college contexts.

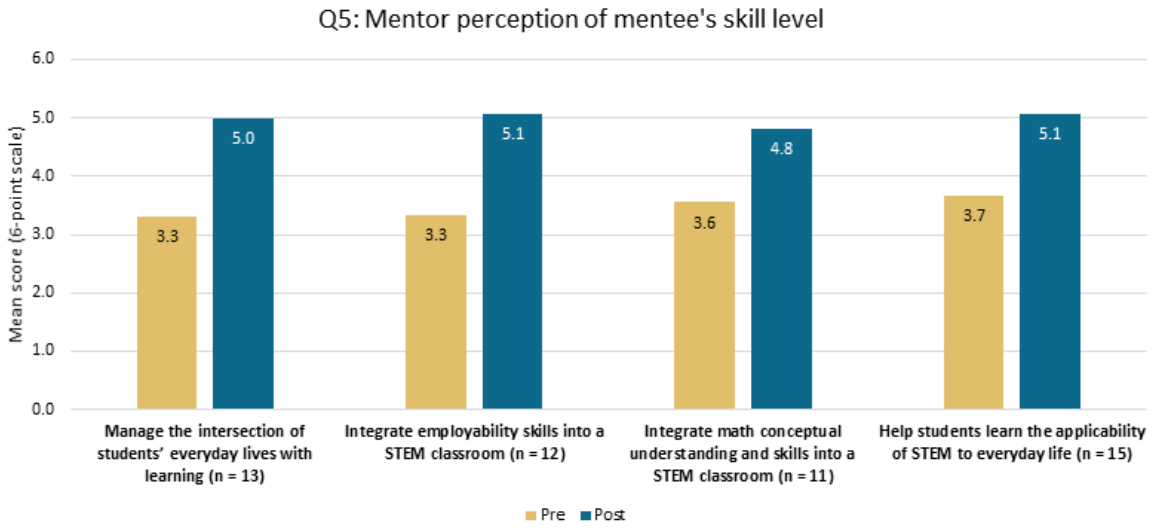

Figure 3: Mentors' perceptions of their mentees' pre and post skill level relative to specific teaching skills (based on survey responses from mentors in 2021-2022)

Mentors found that their participation in the MTP positively shaped their own professional lives. In the 2020-2021 post-survey, mentors were asked, "How did participating in the mentored teaching fellowship influence *your* career interests and development?" Mentors (n = 16) generally found personal interaction with their mentees to be among the most useful components of the teaching practicum. By having personal direct exchanges and conversations with their mentees, mentors reported that they generated fresh perspectives and ideas for their own teaching (n=3) or could better tailor the MTP to their mentees. In the 2021-2022 post-survey, mentors were asked, "What aspect of the mentored teaching fellowship was most useful to you as a mentor, and why?" One Texas mentor shared that "Receiving feedback from the mentee because it's been a while since I had another person who is not my supervisor evaluate my class. I will use her feedback to make new lessons for future semesters." Another Texas mentor reflected on the fact that "Answering questions and guiding my mentees in their assignments helped me to reflect on my own teaching style, and how I can improve as an instructor and faculty member. "A Texas mentor appreciated how "my mentee gave me feedback and shared what she liked and disliked about my teaching style. She gave good feedback and I have actually implemented a few of her suggestions." Across this sample of quotations, we can see how community college faculty mentors appreciated opportunities to give and receive feedback on the work of teaching.

Mentors found their mentoring relationships to be fun and enjoyable. One Texas faculty mentor shared, “It was fun to share my love of teaching.” Another Texas mentor described, “I really enjoyed meeting with my mentee and sharing my experience. I feel that this fellowship helps show mentees that they have many opportunities besides industry or university academia.” Here we see the community college mentor enjoying their experience working with their mentee and being able to share their own experiences working within the community college context. It is noteworthy to us that community college faculty are enjoying this responsibility and are finding their depth of experience and wisdom to be valued within these cross-institutional partnerships.

Mentors also valued the opportunity to train mentees interested in teaching as a profession to cultivate talent and faculty diversity, with one mentor noting "We need committed instructors who are passionate about student learning and success." Another mentor remarked that "becoming familiar with the mentees helps in future recommendations or consideration for future employment at our college if they [sic] mentees interested." This suggests that some mentors recognize that the MTP can build career pathways for their mentees and open doors to faculty positions within their own community college contexts. One Texas mentor shared, “I felt encouraged that there are individuals from diverse backgrounds like mine exploring community college after graduate school.” One Texas mentor urged Regional Change to “continue providing this experience to graduate students. This fellowship is allowing these graduate students an opportunity to test out an entire career, which is phenomenal.”

To summarize, we have growing evidence of mutually beneficial partnerships emerging with CC mentors within these regional collaboratives.

VI. Conclusions

Regional collaboratives across the nation have implemented teaching mentoring practicums to promote academic careers at community colleges. In Texas, these regional collaboratives have partnered with community college administrators and faculty willing to provide experiential learning opportunities to graduate students from diverse backgrounds. Through mentorship, webinar participation, and classroom observations, graduate students learn about the mission of community colleges’ inclusive teaching skills and credentials. Although the experience was adapted from one regional collaborative to another, the perception of participants was positive.

In surveys conducted to collect feedback from faculty mentors, they reported a high level of commitment and perceived that the experience had positively impacted their proteges’ professional skills. Mentors valued the opportunity to cultivate talent and faculty diversity. Lastly, mentors also found their roles in mentored teaching practicums rewarding and shaped their professional lives.

The opportunities offered to current faculty to mentor future faculty may lead to the implementation of additional adaptable interventions that will support efforts to enhance inclusive teaching environments in community colleges. These environments are deemed necessary for the education of an increasingly diverse student population.

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APPENDIX A

Sample Responses from Faculty Mentors (2021-2022 Survey)

From your perspective, what aspect of the mentored teaching fellowship was most useful to your mentee, and why?"

West TX Mentor: "I feel that my mentee benefited from my vast knowledge of pedagogical techniques and experience developing my own curriculum."

West TX Mentor: "Hands on. Advise. Learn about community college philosophy."

West TX Mentor: "The assignments that the mentees had to complete, lesson plans, teaching philosophy, etc., were meaningful in the sense of the process. These assignments led to important teaching moments between the students and me. These students asked many questions concerning how to teach and how you have effective classroom management."

West TX Mentor: "The sessions in which we met to work on the teaching philosophies, observations, and lesson plans were important because working on each of these caused my mentees to reflect on the nature of community college teaching. This developed into a discussion of how community colleges work: from how they are funded, to how people get hired, to how the student body is changing year-to-year, to how technology plays a role in teaching, and how grant-writing and internships play into the career of a community college instructor. In short, my mentees asked me great questions during our sessions, and I think they got a lot out of my answers to these questions."

North East TX Mentor: "Observation of engaged learning activities and lecture techniques gave him new insights into pedagogy."

North East TX Mentor: "My mentee obtained an associate degree from the same community college she taught at during the fellowship. I think it was a great experience for my mentee to see lessons and learning at the community college from both perspectives."

North East TX Mentor: "I believe being able to shadow the many aspects of teaching at a junior college and then implementing what they learned was a crucial part of the process. The observation and then demonstration allowed us both the ability to see the benefits of the program."

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