

Diversifying the STEM Teaching Workforce:
A Process and Tools Described through One Institution's Journey

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Abstract

University teacher education programs are a key bridge across educational systems that are often overlooked by initiatives aimed at advancing equity in STEM education. STEM teachers at all levels are overwhelmingly white, and STEM subjects are still too often taught using pedagogies that ignore the cultural contexts of minoritized communities. Here, we describe a guiding framework and consultative model developed to help university teacher education programs to identify and modify structures, policies, and practices that create barriers to STEM education and STEM fields for minoritized communities in Washington state. This model is based on the theoretical framework of Targeted Universalism and utilizes landscape analyses, professional development, data analysis, and a series of journey mapping and design clinic exercises to recognize assets and identify barriers for targeted communities. In this paper, we summarize the key characteristics and activities of this model and illustrate its application at Central Washington University.

Keywords: STEM, education, teacher preparation, student recruitment, student retention, structural barriers, equity

Diversifying the STEM Teaching Workforce:**A Process and Tools Described through One Institution's Journey**

Close your eyes, think about your algebra teacher. Now think about your high school chemistry teacher. What do they look like? Chances are both teachers were white. Most of our [the authors] teachers in high school were white in an educational system not designed for equitable educational opportunities and outcomes.

Although P-12 student racial demographics have changed dramatically in recent years, the composition of the teaching workforce has remained largely consistent (NASEM, 2020). Elementary and secondary teachers who identify as white stand at 82% at the national level, whereas students from minoritized populations comprise over 50% of P-12 public school enrollment (Carver-Thomas, 2018). This imbalance is magnified for high demand Science, Technology, Engineering, and Mathematics (STEM) fields, in which teachers are approximately 90% white in all levels of science and mathematics (Banilower, 2018). Increased representation in the teacher workforce by members of minoritized populations is essential for modeling STEM workforce engagement for students from those communities, as well as critical for changing STEM education toward a model that centers students' backgrounds, families, and communities, and engages students in the practices of STEM fields in culturally sustaining ways (Goldhaber et al., 2019; Carver-Thomas, 2018; Easton-Brooks, 2019). The number of prospective minoritized teachers decreases at multiple points along the educator pipeline. Identifying and addressing those points is critical in diversifying the STEM teaching workforce (Carver-Thomas, 2018; Noboa-Rios, 2019, p. 5).

Equally important to working toward a teacher workforce that is more representative of its students, a more equitable educational system needs all teachers to engage all of their students

and communities through culturally sustaining pedagogies that recognize students' authentic brilliance and diverse ways of being and knowing (Alim & Paris, 2017). In fact, recent research has shown that teacher education programs that promote teaching in the context of social justice, and themselves model cultural-responsiveness by using community-centered curriculum and pedagogies, improve recruitment and retention of candidates of color from high school into professional teaching careers (Gist et al., 2021). It is thus essential that STEM teacher education programs working to diversify assess many aspects of institutional and program structure and culture, including environment, curriculum, policies, and practices, in the context of the minoritized communities that they hope to serve (Gazmuri et al., 2010).

Here, we describe a consultative model and tools to support teams from STEM teacher education programs in developing strategies toward recruiting or retaining more minoritized teachers of STEM. This model is a subset of work supported by the NextGen-WA Consortium, a National Science Foundation funded partnership among several institutions of higher education (IHE), governmental organizations, and non-governmental groups in Washington state (Geary et al., 2021). The consortium began in 2016 with the goal of using collaboration to improve STEM teacher education and diversify the STEM teaching workforce. IHE involved in the NextGen-WA Consortium produce 90% of science and mathematics teachers in Washington state. The consortium utilized a structure of two foundational working groups - Organizational Change and Diversity - and six critical area working groups - Mathematics in STEM, Clinical Practice, Computer Science Integration, Engineering Integration, Pedagogical Content Knowledge, and Education for Sustainability. These cross-institutional working groups adapted research-based frameworks and created tools and resources within their area and then utilized these to support IHE-based implementation teams in improving aspects of STEM teacher education as aligned to

the overall consortium goals. To work toward the consortium goal of diversifying the STEM teacher workforce, the NextGen-WA Consortium Diversity Working Group (DWG) developed a Diversity Campaign, in which they supported several IHE across Washington state through professional development, landscape analysis, and developing an action plan to address objectives toward recruiting or retaining more minoritized teachers of STEM. In this article , we introduce the key features of the DWG and Diversity Campaign and illustrate those features by describing how they were applied at one IHE in Washington state, Central Washington University.

Preparing for a Diversity Campaign: Partners and Processes

The DWG was envisioned as a consultative group, providing guidance, instruction, and focus to the work of the NextGen-WA Consortium. The DWG consisted of seven members representing mathematics, science, and education departments at various universities, as well as representatives from partnering community organizations. The DWG members included:

- an associate professor of science education
- a professor of biology and science education
- a professor of physics
- an associate professor of education
- an assistant professor of education
- an executive director of a local mathematics education nonprofit organization
- a STEM educational consultant and community advocate.

In addition to representing a variety of STEM disciplines, DWG members all had strong community connections, including volunteering, advocacy, fund raising, mentoring, and informal education. Furthermore, they had a passion for engaging in work related to systemic change and

were committed to creating meaningful, lasting partnerships between IHEs and communities and families. The DWG had an even gender distribution, and all members identify as persons of color, representing multiracial, Hispanic/Latinx, Asian, Black, and Indigenous groups.

The DWG met monthly (both in person and via Zoom) throughout the course of the NextGen-WA Consortium project (2016 - 2022). Initially, the DWG focused on reading and discussing the literature related to diversity in STEM education, as well as crafting a vision and mission for their work on the grant. Driven by a vision that students from all backgrounds see a path to becoming a STEM teacher, the DWG has sought to operationalize research-based practices for diversifying the teaching workforce through five principles.

1. Principle 1: Diversity in STEM is a strength/ an asset (O’Leary et al., 2020)
2. Principle 2: Communities, including Institutions of Higher Education, IHE, have localized knowledge and expertise (Cox, 2000)
3. Principle 3: Communities, including IHE, demonstrate the commitment to diversify the STEM teaching workforce (Carver-Thomas, 2018)
4. Principle 4: Systemic change is not a quick fix; rather identifying barriers and analyzing historically exclusionary practices, policies, and programs, take sustained, concerted, collaborative, and receptive energy/effort/resources (Powell, 2016)
5. Principle 5: All P-12 students benefit socially, emotionally, and academically from increased diversity in the teaching workforce (Kozleski & Proffitt, 2020)

The DWG led NextGen-WA Consortium project-wide workshops, participated in annual consortium retreats, and developed a consultant model (i.e., Diversity Campaign) to help IHE develop strategies for diversifying the STEM teaching workforce.

In all instances, the DWG emphasized that diversity in pre-service STEM education goes beyond changing the demographics of those who major in STEM fields and engage in STEM teaching and learning. Diversity in pre-service STEM education involves a reexamination of who is seen as capable of being part of the STEM community, what issues are of importance to diverse communities touched by STEM fields, and how communities can come together to support their members to pursue careers in STEM education. Most importantly, diversity in pre-service STEM education requires a commitment of existing agencies (i.e., government, P-12, and postsecondary education) to the values of communities and to examine and address inequitable structures, policies, and practices. Therefore, the mission of the DWG is to diversify the STEM teaching workforce through acknowledging and finding ways to navigate and modify persistent structures, policies, and practices that create barriers to STEM education and STEM fields for minoritized communities in Washington state.

Guiding Framework

The theoretical framework that guides the DWG work is the concept of Targeted Universalism (Powell, 2016), which is defined as

... an approach that supports the needs of the particular while reminding us that we are all part of the same social fabric. Targeted universalism rejects a blanket universal which is likely to be indifferent to the reality that different groups are situated differently relative to the institutions and resources of society. It also rejects the claim of formal equality that would treat all people the same as a way of denying difference. (p.3)

According to Banks et al. (2004), “diversity describes the wide range of racial, cultural, ethnic, linguistic, and religious variation that exists within and across groups that live in multicultural nation-states” (p. 17). Given this focus on diversity, many institutions seek to recruit and support

individuals from diverse backgrounds. Yet many struggle in their diversity efforts, often wondering why their initiatives fall short of their stated goals. Recognizing these trends, the DWG employs targeted approaches with colleges and universities, which acknowledge the pluralistic nature of communities and seek to identify the needs of prospective minoritized students in the areas of recruitment, admission, retention, and student support. Since every college and university is situated in unique communities, place plays a key role both for the institution and the students being recruited. According to Nieto (2009), "... diversity education recognizes the pluralism that students embody (racial/ethnic, social class, gender, place, and other) as resources to be used in the service of their education ..." (p. 19). Targeted Universalism will thus yield different recommendations depending on each IHE's context, which includes local people, communities, and aspirations.

The DWG also recognizes that there are some factors that transcend local communities, such as the persistence of high stakes testing, college entrance and placement exams, requirements for students to enter teaching education programs, subject matter tests, and, up until recently, the consequential edTPA, a comprehensive portfolio of materials and written commentaries required during student teaching (Pearson Education, 2022), for certification, all of which correspond to economic privilege and maintain structural inequities (Gorlewski & Tuck, 2018; Nichols & Berliner, 2007). The DWG approach thus seeks to identify and correct "structural inequalities in society that impede equitable outcomes in education, not to mention in life, and it recognizes the role of the state in addressing such inequalities" (Nieto, 2009).

Assessing Readiness

Prior to the Diversity Campaign, each IHE was asked to review and discuss a series of questions (Figure 1). These questions were designed to help each institution assess their own

readiness to begin the Diversity Campaign. The DWG's goal was to promote a consultative structure, where each institution would take on leadership roles in this work.

Figure 1

Diversity Campaign Readiness Questions

Assessing Implementation Teams' Readiness to Engage with Diversity Working Group Campaigns

Please share and discuss to see if your team is ready to engage with the Diversity Working Group's Campaign. These questions will help you determine if there are conditions and resources to support change, a vision for intended change, and broad motivation to engage with change.

- Describe your institution's support for increasing the diversity of the STEM teaching workforce.
- Describe your institution's stated commitment to Diversity/Equity/Inclusion in mission, vision, and strategic plans.
- Who are the colleagues you can readily identify and engage to support this work (i.e., on your team or others you could recruit/garner support from)? Who are other stakeholders in STEM teacher preparation who need to be part of the process?
- Identify a group of faculty, staff, students, community partners, and administrators from across disciplinary fields (STEM and Education) who would meet in person for half a day three times this academic year to review the Diversity Landscape questions with Diversity WG partner/pairs?
- To what extent are there other (existing) resources, programs, initiatives within your institution and/or in your partnering K-12 schools to leverage support for increasing diversity of the STEM teaching workforce?
- Do you have access to data on current/historical STEM TP program majors/graduates, and/or data on the diversity of STEM K-12 teachers and students in local communities, etc.? If not, do you know who to contact at your institution to get these data and can you partner with them this year?
- Who will facilitate this group in:
 - writing a narrative about the moral, social/emotional, cultural, and democratic imperative for your institution to diversify the STEM teaching workforce?
 - designing how your institution will address that imperative? The design plan should:
 - address a broad vision,
 - consider your particular landscape
 - include mechanisms for tracking progress
 - promote communication, collaboration and input among all people and sectors impacted by change
 - include feedback mechanisms for making iterative improvements
 - include strategies and tactics to handle resistance and bottlenecks, and ensure that all stakeholders work to identify possible resistance and bottlenecks
 - include strategies to acknowledge milestones
 - include strategies that engage stakeholders that represent the diversity focus for your context

It is important to acknowledge that these readiness questions were developed for universities that already had at least three years of history engaging with the DWG through the NextGen-WA Consortium. Over that time, grant partners attended workshops focused on diversity, equity, and inclusion (DEI). More importantly, the DWG piloted landscape analysis tools, which assisted each IHE in examining their current landscape and gaining insights related to the needs of minoritized populations in their communities. According to National Student Support Accelerator (2021), a landscape analysis “outlines the strengths, resources, and needs of a particular community” (p. 12). Specifically, stakeholders in the community (in our case, faculty, staff, alumni, and students) collect and examine information related to a specific area of interest or concern. This information includes, but is not limited to, surveys, focus groups, observations, reports, research studies, and interviews. A landscape analysis provides stakeholders with a picture of the “strengths, gaps, needs, opportunities, and threats” (p. 13) related to the focal issue. Most importantly, stakeholders can begin to construct action plans that address concerns raised during the landscape analysis process.

Three IHE in Washington state completed the initial readiness questions and engaged in the Diversity Campaign over 2019 - 2021. Over this time, Diversity Campaign participants identified and modified ineffective recruitment strategies, sought out additional funding to support students academically and socially, engaged in professional development focused on anti-racist pedagogy, made important connections to community partners, and strengthened partnerships with other campus offices engaged in DEI work. Most importantly, Diversity Campaign participants acknowledged that diversifying the STEM teaching workforce is complex and multidimensional: it requires short and long-term strategies that provide varied opportunity

structures for students from minoritized communities. In the next section, we illustrate the Diversity Campaign process through its application at one IHE, Central Washington University.

Application at Central Washington University

Context and Readiness

The DWG worked with a team of faculty, staff, and students from Central Washington University's (CWU) Teach STEM program over 2019 - 2021 to identify policies, practices, and structures that support retention of minoritized students and develop an action plan for change. CWU is a regional comprehensive university, offering undergraduate and master's degrees at its primary location in rural, Washington state (Ellensburg, WA), as well as seven "centers," co-located at community colleges in western and central Washington. Established as the Washington State Normal School in 1891, CWU has a long history of training teachers, including those in STEM. STEM teacher education at CWU went through a major change over 2016 - 2019 by implementing the national UTeach STEM teacher education model program (called Teach STEM at CWU) for all undergraduate students seeking initial teaching certification and endorsement in middle level and secondary science and mathematics fields (Dechaine and Loverro, 2020; The UTeach Institute, 2022). CWU's top implementation priorities were to institutionalize Teach STEM and increase the number and diversity of STEM teachers graduating from CWU. As increasing diversity was the most challenging priority, CWU was enthusiastic to complete the readiness questions for the Diversity Campaign.

An interesting part of the process was that CWU answered the readiness questions twice. The first answers were a descriptive summary of CWU's institutional and program goals with names of possible participants and a list of "diversity" initiatives. The DWG challenged CWU to revise these first answers to better capture the self-awareness and humility that would be needed

to begin to identify systemic structures of oppression for targeted minoritized communities. Although the Diversity Campaign process can benefit by partnering with existing IHE DEI initiatives, it is also important to recognize that not all initiatives center the needs of minoritized students or include the difficult work of identifying historically exclusionary systems and practices. The DWG challenged CWU to acknowledge that despite investment in DEI work, systemic structural inequity in STEM teacher education persists. A quote from CWU's revised readiness answers illustrates CWU's work toward embracing more humility:

Below, we discuss many of the CWU initiatives aimed at increasing diversity. They show that our university publicly recognizes the importance of diversity and inclusion. What they don't show is that too often this support is superficial and many of our units, including the Teach STEM program, have significant work to do to support minoritized students, faculty and staff. We don't feel like we have strong strategies for supporting STEM teaching candidates from minoritized populations or exactly how to get the data we need to support ALL of our candidates from recruitment through after they graduate (CWU Campaign Team, personal communication, October 14, 2019).

We include this quote to illustrate the importance of humility, critique, and self-reflection to engaging in work addressing systemic oppression (Tervalon & Murray-Garcia, 1998). As described above, years of collaboration among the DWG, CWU, and other IHE in Washington state through the NextGen-WA Consortium developed a trusting relationship that promoted self-reflection and cultural humility in participating individuals, which is a necessary first step in recognizing how institutions create structural barriers for minoritized populations (Freire, 2018; Nieto & Bode, 2018; Tervalon & Murray-Garcia, 1998).

Campaign Team

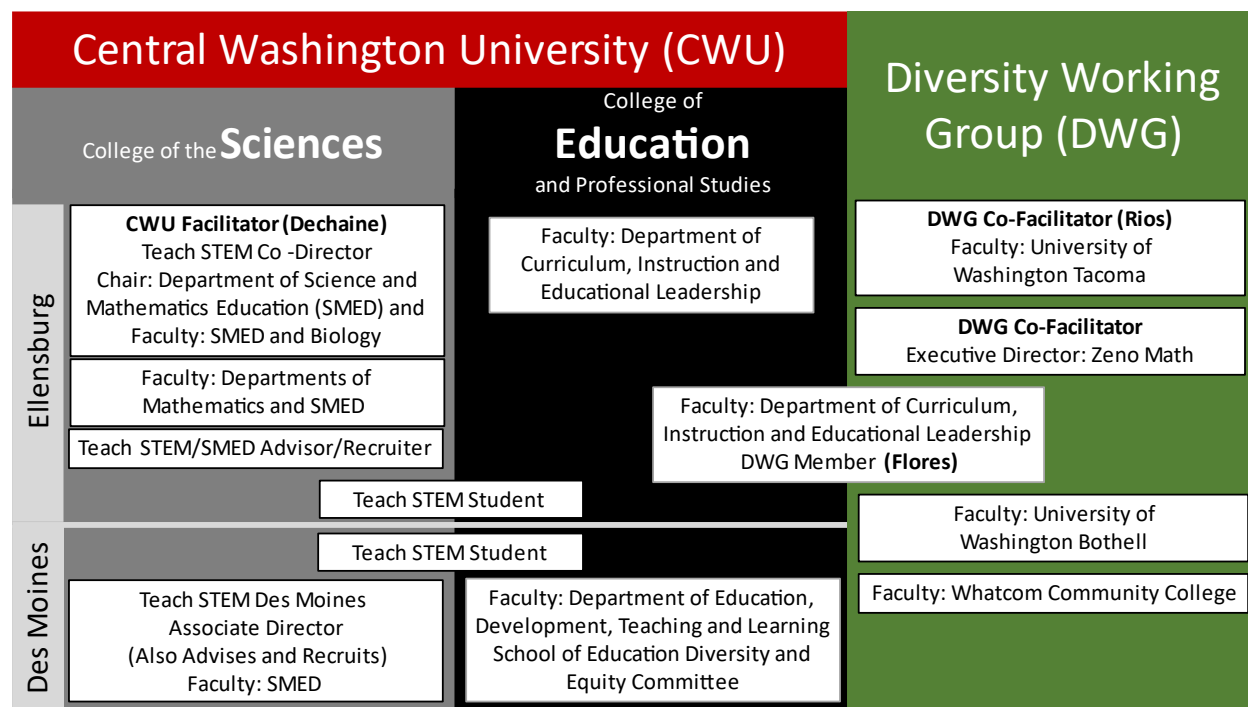
One of the most important first steps was to recruit people strategically to be part of the CWU team who would work directly with the DWG. CWU's Teach STEM program is a partnership between CWU's College of the Sciences and College of Education and has programs on two campuses (Ellensburg and Des Moines). We intentionally recruited at least one faculty member from each college and campus, as well as faculty that represented the main content areas of the program (i.e., educational foundations, secondary mathematics, secondary science, and middle level mathematics and science) (Figure 2). We also included the program advisor/recruiters, who do the most work in directly recruiting and supporting students, a faculty representative from CWU's School of Education Diversity and Equity Committee, as well as one student from each campus who was part of at least one minoritized community (e.g., urban immigrant, rural Latinx). In addition, we were lucky that one of the DWG members was also a CWU education faculty member who teaches in the Teach STEM program.

Each person brought unique perspectives to the conversations, which often yielded surprising insights. To engage these perspectives, it was important to create safe and supportive environments for all conversations, because the power dynamics among various groups at an institution can take precedence over frank exchanges on information and ideas. For example, staff can feel anxious about presenting contrary information to faculty and administrators; yet they are often privy to student and community perspectives because of their regular interactions outside of the institution. Students frequently have different perspectives on support offered by programs and their degrees of effectiveness. Strategies we used to create a safe environment for discussion included recruiting self-reflective individuals to the team, setting norms of discussion

in our first meeting (Table 1), and having experienced facilitators from the DWG promoting dialogue and re-focusing conversations throughout the meetings.

Figure 2

CWU – DWG Team Structure



Note. Diagram showing professional positions for team members from Central Washington University (CWU) and the Diversity Working Group (DWG) who worked together on the Diversity Campaign. Each white box represents an individual. CWU personnel are organized by their college at CWU (College of the Sciences or College of Education) and at which campus they primarily reside (Ellensburg, WA or Des Moines, WA). Students and Flores bridge multiple areas. This article's authors' names are bolded. Five CWU team members identify as White and four identify as persons of color, including Multiracial, Hispanic/Latinx, and Asian ethnic or racial groups. The DWG had an even gender distribution, and all members identify as persons of color, representing multiracial, Hispanic/Latinx, Asian, Black, and Indigenous groups.

Campaign Activities

CWU and the DWG engaged in several key activities during five, two-to-three-hour meetings from February to July 2020 (Table 1). The first meeting started with norm setting and professional development on Targeted Universalism, followed by an analysis of two student groups using the Diversity and Inclusion with a Targeted Universalism Approach Tool (DWG, 2019). Grounded in the notion that specific communities have unique assets and needs, team members provided information about community perceptions of CWU's outreach efforts, current targeted retention strategies and supports, barriers facing students from those communities (both actual and perceived), and partnerships that address these barriers (e.g., historical, current, and planned). We then explored these supports and barriers and how they may affect individual students using a combination of journey mapping student personas (Figure 3) with design clinics aimed at identifying barriers and supports to student retention (Figure 4).

Table 1

Diversity Campaign: Summary of Meetings and Activities.

Meeting Number	Focus	Main Activities
Meeting 1	Orientation to the theoretical framework and understanding our work	● Review of Theoretical Framework – Targeted Universalism ● Establishing Group Norms ● Activity & Discussion- Diversity & Inclusion with a Targeted Universalism Approach (DWG, 2019)
Meetings 2 & 3	Learning about ourselves and our students	● Journey Mapping ● Design Clinics ● Identifying data and information needs

Meeting 4	Moving forward with what we have learned and creating an action plan	● Examining student data ● Setting objectives ● Articulating actionable steps ● Measuring progress ● Creating timeline
Meeting 5	Reviewing and presenting the action plan	● Examining and revising the action plan

Note: Meetings occurred over six months, with approximately one meeting per month.

Journey mapping is a tool used by businesses to identify specific groups of customers and tailor strategies to engage those customers with their products (Yates & Redfern, 2018). It is also used to track customers' interactions with products over time. We adapted the journey mapping exercise using the Nielson Norman Group's approach, which defines journey mapping as "a visualization of the process that a person goes through in order to accomplish a goal" (Gibbons, 2018). The first step in creating this visualization was to identify the constituent groups (i.e., student demographic groups) and create personas from each group (Future Point of View, 2016). We created two personas for CWU, one for each campus. As an example, Figure 3 presents the persona created for the Ellensburg campus. It is important to note that in order to avoid stereotypes, personas should be developed in collaboration with the community they represent, which in our case was students of similar identities.

Figure 3*Example Student Persona Developed for Journey Mapping*

REGINA	
BIOGRAPHY	
Gender	Female
Age	22
Race	Native American
Language	Yakama, English
Hometown	Granger, WA
Relationship	Single parent
Living Situation	Multigenerational household
Hobbies	Watching and playing sports
CWU Admission Status	Admitted transfer student
Major/Endorsement Area	Secondary mathematics
GOALS	BARRIERS
Make an impact	Access to technology at home
Attend graduate school	Navigational capital at CWU/Ellensburg
Be employable	Financial
Spend time with child	Childcare
Give back to her community	Finding affinity groups/campus friends
Teach math in her tribal language	No faculty experience in strategies for teaching math in tribal languages
	Travel to/from campus OR finding a new place to live closer to campus

Note. We used the journey mapping framework to develop two student personas: Regina for CWU – Ellensburg and Tzotzil for CWU – Des Moines. Here we show Regina’s biographical information, goals, and barriers.

Once we created personas for each campus, we modified the journey mapping experience and engaged in a design clinic (Community Engagement Fellows, n.d.). Simply put, a design clinic uses a 30-minute protocol to engage participants in an open exchange of ideas about a specific issue. According to the Community Engagement Fellows (n.d.), participants should “think about each design clinic as a chance to learn about a new context, listen for useful experience and advice, and to reflect on their own work.” What drives a design clinic is a question posed by a group member, usually a member from the focal institution. For CWU, we brainstormed several possible design clinic questions, and chose the question “Could you help me understand how Regina would learn about support and/or retention strategies prior to and/or after admission to CWU?” (Figure 4). We then followed the design clinic protocol, which engages in a strictly timed discussion where the group inquires about the context of the question, shares stories and experiences related to the question, and provides suggestions for next steps. Each design clinic ended with the questioner, who was also the lead Teach STEM faculty member for that campus, sharing the most impactful parts of the conversation. Our design clinics included all CWU team and DWG members, 8-12 people for each clinic.

Figure 4

Example Design Clinic Questions for CWU's Context

1. Could you help me understand how *Regina* would learn about support services *after admission to CWU*?

2. Could you help me understand how *Tzotzil* would learn about support and/or retention strategies *prior to admission to CWU*?

3. Could you help me understand how a community college student would see a pathway to becoming a secondary STEM teacher?

4. Could you help me understand how students navigate time and course expectations in their STEM education courses?

5. Could you help me understand what strategies work for incorporating authentic student voice into STEM teaching program improvement?

6. Could you help me understand how faculty incorporate anti-racist and/or social justice topics into courses taken by STEM education majors, including science and math content courses?

7. Could you help me understand how faculty learn about universal design and incorporate that into courses taken by STEM education majors?

Note. We explored journey mapping scenarios using design clinics. Design clinics start with an open-ended and specific question using the format “Could you help me understand...”. We brainstormed questions addressing student support services (questions 1 and 2), pathway navigation (3 and 4), student voice (5), and incorporating social justice and universal design into program curriculum (6 and 7). The team felt that deeply exploring student support services would be an important first step in addressing barriers and supports in student retention and thus chose to utilize questions 1 and 2 for Regina’s and Tzotzil’s respective design clinics.

In addition to the journey mapping and design clinics, we examined student enrollment and retention by demographics for the Teach STEM program. Specifically, we compiled

Integrated Postsecondary Education Data System (IPEDS) ethnicity and race, gender, adjusted gross family income, and expected endorsement area(s) for all students who had taken a course in the Teach STEM program in the last three years. Some of these data were provided by CWU's institutional research office and others, including data on why students left the program, had been collected through student surveys and through conversations with advisors since the start of the Teach STEM program. We then combined these data with program and course enrollments to examine student enrollment by each demographic factor as compared to the colleges and overall university, as well as examine student retention in the Teach STEM program by demographics.

Learnings and Action Plan Objectives

Our fourth meeting focused on using all of the different types of data to surface several themes. For example, student data showed no significant differences in retention by IPEDS race/ethnicity, but there were differences by family income. Program retention was over 10% lower in students from the two lowest income groups versus all other income groups. Further analysis revealed that approximately 75% of non-retained students in these two low-income groups left CWU entirely, in contrast to higher income students, who were more likely to leave the Teach STEM program but stay at CWU.

The design clinics revealed that although each CWU faculty, staff, or student team member knew of student support services, no one had a comprehensive understanding of a large range of services, and this information was not available in any one place. Although our design clinics did not focus on student voice, our discussions surfaced that the Teach STEM program has limited information about student experience and why students leave the program or CWU. Finally, although we were glad to see that Teach STEM's racial/ethnic make-up was generally representative of the overall CWU student population, that raised questions of how

representative our graduates are of students in our partner school communities and statewide. These learnings led to the development of an Action Plan with four objectives.

Action Plan Objectives:

1. Analyze existing, state- and program-level quantitative data describing candidate representation of students in partner communities.
2. Review and examine existing class and program surveys to collect robust data to describe candidate experience in Teach STEM; Begin to develop new interview protocol.
3. Identify and communicate existing resources for student support in a central location on the Teach STEM website; increase Teach STEM 's awareness, effective use of, and relationship with support services.
4. Identify and integrate effective strategies to support relationship building within and between Teach STEM and targeted communities.

When developing the Action Plan, we chose to include both “low-hanging fruit” objectives that could be completed that year with limited resources (i.e., during the first year of the COVID pandemic), as well as objectives that would drive future work and guide us should an opportunity for more funding arise. For example, objectives 1, 2, and the first part of 3 could be completed in a year. The second part of objective 3 (i.e., increase Teach STEM program's...) and objective 4 could be started in the first year but are also long-term objectives with sub-objectives that require additional funding. We broke each objective into one to four sub-objectives, which were then assigned specific tasks, resources (including personnel), and a timeline. The CWU team lead drafted the Action Plan, which was reviewed and revised by the full team and the DWG at our last meeting in July 2020. The Teach STEM program Steering

Committee approved the Action Plan in September 2020. Originally, we planned to meet formally with the DWG at six-month and one-year time points to assess progress on our objectives, but these became more informal check-ins with the DWG facilitators due to changes in participants' responsibilities and capacity over the COVID-19 pandemic.

Action Plan Progress

CWU was able to utilize NextGen-WA Consortium funding to hire two undergraduate students to work on the Action Plan, and they chose to start with objective 3. These students, mentored by two faculty members, worked together to develop a comprehensive list of student support services relevant to Teach STEM program students. They organized each service with its contact information and description into categories using a sortable Google Sheet and shared it with all Teach STEM program faculty and staff.

Also serendipitous was the Washington State Professional Educator Standards Board (PESB) call in September 2020 for applications for their Teaching Equity Grant (PESB, 2020). The student data and Action Plan formed the argument for Teach STEM's need of and readiness for additional funding, and a subgroup of the CWU team received a Teaching Equity Grant over 2021 - 2023 for a deeper assessment of equity in Teach STEM's policies, curriculum, culture, and praxis, followed by faculty professional development around use of culturally sustaining pedagogies in the context of STEM teacher education. To date, the team has used that funding to contract Quetzal Educational Consulting (Quetzal, 2021) to develop a guiding tool for conducting a deep-dive analysis into Teach STEM program students' demographics in relation to partner K-12 students (Action Plan Objective 1). We also co-developed a focus group protocol and conducted graduating senior and alumni focus groups around identity, cultural safety, and environment in the Teach STEM program and at CWU and are analyzing these data for future

publication (Action Plan Objectives 2 and 3). Furthermore, although relationship building during the COVID pandemic has been very challenging, CWU has initiated several meetings with local programs that have goals and success in recruiting more diverse teachers (e.g., Teaching Academies, Seattle Public Schools Academy for Rising Educators) to discuss needs for improving pathways into STEM teaching (Action Plan Objective 4). Overall, CWU has made progress on all four Action Plan objectives and plans to use the new data generated through the Teaching Equity Grant to continue to update the Action Plan.

Key Learnings/Recommendations for Future Work

Those who are most directly affected by the work must be part of the team

CWU's campaign focus on retention directly affects students. Thus, it was essential that students were full members of the CWU team. We employed two students, one each from Teach STEM program's two campuses, to attend all meetings and work on action items over 2020 – 2021. We chose self-reflective students who were connected to their identity, communities, and other program students from similar communities. This supported the work by providing authentic student perspectives to the journey mapping and design clinics. It also benefited the Teach STEM program's relationship with students, as the students were pleasantly surprised that faculty had a better understanding of the barriers they faced than expected.

One group directly affected by this work but not included in the Diversity Campaign was students who were not retained in the Teach STEM program and/or at CWU. It is an open question as to how applicable the identified barriers and supports are to unretained students, especially those who left CWU. It would have been difficult to include these students in the campaign exercises due to lack of contact information, but we recommend that a future action plan includes an objective for reaching these students, such as an exit survey or interview.

One of the outcomes is the journey itself

Part of the CWU-DWG work was learning to embrace its complexity and long-term nature. Systemic racism, classism, other -isms and a reluctance towards praxis make the change process slow and complicated. There is no “quick fix” or single initiative that will result in a STEM teaching workforce that mirrors the diversity of children in Washington state. Ongoing professional development and relationship building, as part of the NextGen-WA Consortium, as well as personal reflection by members of the CWU team, helped shift Teach STEM program’s mindset toward one of continual, targeted change.

Utilize your system

Positively, in Washington state, there is increased urgency for and recognition of the importance of making changes that support increased diversity, equity, and inclusion in STEM teacher preparation. For example, PESB, which oversees all Washington state teacher education, recently committed to rewriting their cultural competence, diversity, equity, and inclusion standards. Starting in 2023, all teachers in Washington state will be required to take 15 hours of professional development focused on DEI. Thus, a future action plan revision for CWU could include a sub-objective to create partnerships with PESB to provide STEM-focused DEI workshops for teacher education faculty and students.

We recommend that any team wishing to address diversity in STEM teacher education spend time investigating your state’s goals and initiatives regarding teacher diversity, teacher recruitment, STEM pipeline recruitment and retention, especially around diversity, cultural competence, and general justice, equity, diversity, and inclusion. There are also major grant opportunities through the National Science Foundation and Department of Education that could fund large collaborations around STEM teacher diversity.

Action plans should include the short and simple, as well as the long-term and complex

Although CWU's action plan focused on the next year, some objectives were included that would require additional resources. For example, one sub-objective of objective two was "develop protocol and plan for interviewing program graduates and students," which would require additional funding for the researchers and participant stipends. Including long-term objectives made it possible to quickly write an additional grant.

Journey mapping personas should recognize assets

The original journey mapping framework and example persona focuses on barriers that a student may be facing and does not include assets (Figure 3). When developing later personas, we realized that it was important to include a 5th category outlining the persona's assets. Example assets that we could have identified for Regina are: multilingual, connected to community, passion, drive, experience with children, and potential for coaching. Identifying these assets provided ideas for structures that could be created that would retain students by promoting these assets. For example, instructors could provide an opportunity for Regina to interact with her own children's classroom in her community as an alternative assignment to requiring her to travel to campus for practicum.

Conclusion

The Diversity Campaign applied the framework of Targeted Universalism to examine barriers and supports to retention of minoritized students in the Teach STEM program at CWU. This framework acknowledges that context, in all its complexities and nuances, is key. Each community has its assets and challenges when supporting their students from P-12 to college and universities. By tapping into the wealth of knowledge and experiences of our communities, we can better position ourselves to provide targeted solutions for specific populations. Although

only one institution's work was described here, the DWG has now worked through this model with several STEM teacher education programs in Washington state and identified a range of solutions to support student recruitment and retention that differ by institution and student population. Although this model was developed for STEM teacher education programs at IHE, it could be adapted to many contexts with diverse targeted populations. In particular, we have found that the process of 1) developing a persona in collaboration with the constituents you hope to represent, 2) writing one to three specific design clinic questions, and then 3) going through the design clinic process with a diverse group quickly surfaces strategies and resources that can be turned into an action plan. Regardless of the context, it is important to keep students at the center of the conversations and bring together a diverse group of people who are a) committed to the long-term work of examining policies, procedures, and practices, b) unafraid to name and dismantle discriminatory systems and structures, and c) ready to build new systems that provide multiple ways for students to enter and succeed in STEM pathways.

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