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RECEIVED 10 February 2025

ACCEPTED 21 March 2025

PUBLISHED 09 April 2025

CITATION

Hill LB, Buchanan D, Woods SE and
Frey RF (2025) Faculty case studies on
learning to teach inclusively in undergraduate
STEM education.
Front. Educ. 10:1574464.
doi: 10.3389/feduc.2025.1574464

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Faculty case studies on learning to teach inclusively in undergraduate STEM education

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Introduction: This study aimed to understand how STEM faculty members developed as inclusive instructors after completing a free, high-engagement, inclusive teaching development program. The Inclusive STEM Teaching Project (ISTP), a Massive Online Open Course (MOOC), provides participants with five modules and additional learning opportunities that dig deep into instructor and student identity, classroom climate, and diversity, equity, and inclusion (DEI) in higher education.

Methods: We conducted nine, mixed methods in-depth case studies with faculty member course participants across the U.S. and various STEM disciplines.

Results and discussion: Results demonstrated iterative growth incorporating instructor identities in cognitive, affective, confidence, and behavioral outcomes. The paper concludes with a conceptual framework that showcases the development of inclusive instructors in higher education.

KEYWORDS

inclusive teaching, faculty development, undergraduate STEM education, case study, qualitative

Introduction

The US-Soviet Space race arguably solidified the importance of America's science, technology, engineering, and mathematics (STEM) workforce within the global economy (Thelin, 2019). Since then, politicians, practitioners, and researchers have argued for and debated the expansion, diversification, and enhancement of that workforce to maintain and advance human and economic goals (Camilli and Hira, 2019; National Science Board, National Science Foundation, 2024). Yet, there are still concerns about our education system's ability to produce the needed and well-trained, diverse individuals to enter the STEM workforce (National Center for Science and Engineering Statistics (NCSES), 2023; President's Council of Advisors on Science and Technology (PCAST), 2024).

One major concern is the inequities that persist for underrepresented student populations in STEM, which has resulted in stark contrasts between majority and non-majority retention (Committee on Science, Technology, Engineering, and Mathematics (CoSTEM), National Science and Technology Council (NSTC), 2024; National Center for Science and Engineering Statistics (NCSES), 2023; Whitcomb and Singh, 2021). Research has identified key factors that influence underrepresented students' decisions to leave STEM majors, including feelings of belonging, the ability to develop self-efficacy and science identity, incidents of implicit and explicit bias, having instructors share the same racial and cultural identities as their students, and a welcoming course climate (Beasley and Fischer, 2012; Estrada et al., 2016; Hansen et al., 2024; Hughes, 2018; Morton and Parsons, 2018; Park et al., 2020; Wilson et al., 2012). Faculty members constitute a large proportion of students' direct connection with their institution and

represent a major mechanism by which students experience the collegiate atmosphere. Teaching quality is strongly connected with decisions to leave, especially in STEM, since the classroom is where students can develop positive or negative self-efficacy, science identity, and belonging (among other factors), which are strong predictors of student learning and success (Ballen et al., 2017; Freeman et al., 2007; Perez et al., 2014).

Scholars and practitioners have spent decades advancing evidence-based teaching strategies to address teaching and learning challenges (Andrews et al., 2022). Thus, it is accurate to say “good,” “active,” and student-focused teaching has been well-defined. Yet, not to negate the solid foundation of prior work but to build upon it, more recent scholarship has argued for a reimagining of “good” teaching to offer inclusive learning environments that (1) acknowledge the many unique student and faculty identities (Barnett, 2013; Morton and Parsons, 2018) and (2) address the recruitment and retention challenges of underrepresented groups in STEM. Prominent, national programs such as HHMI’s prior Inclusive Excellence Program and the Inclusive STEM Teaching Project (ISTP) demonstrate increased attention to the importance of inclusive teaching, not to mention the many campus-based initiatives that have surfaced since the resurgence of human rights activism in 2020. However, despite some campus-based assessments (e.g., Booker et al., 2016; Ceo-DiFrancesco et al., 2019; Dwyer and Smith, 2020; Schmid et al., 2016), limited research exists that examines the impact of high-engagement inclusive teaching professional development (PD) and how STEM faculty develop as inclusive instructors.

Through nine, in-depth faculty case studies, we examined the following research question: How do STEM faculty members who participated in a high-engagement inclusive teaching development program develop as inclusive instructors? Below, we *first*, describe the context of the ISTP initiative and situate our study within the faculty development impact literature; *second*, we describe our research participants and methods; *third*, we present and discuss our results; and *lastly*, provide recommendations and concluding observations.

Background

Inclusive teaching

Inclusive teaching has gained recent recognition, though it has deeper historical roots (e.g., Marchesani and Adams, 1992). While there is no universal consensus on the definition of inclusive teaching, authors such as Dewsbury (2017) have described it as “a philosophy of teaching that provides equal opportunities for all students to have a successful learning experience (pg. 2).” Congruent with advancements such as the learning paradigm (Barr and Tagg, 1995), student-centered instruction (Weimer, 2013), and active learning (Felder and Brent, 2009), inclusive teaching emphasizes the uniqueness of student and instructor identities in teaching and learning environments (Oleson, 2023). This requires the intentional adoption of pedagogical strategies that promote both minority and majority student success (Addy et al., 2023; Dewsbury et al., 2022; Goering et al., 2022; Sathy and Hogan, 2022; White et al., 2020). Inclusive teaching practices emphasize addressing structural biases and discrimination in curriculum design, activities, and assessment (O’Leary et al., 2020; Williams, 2019). Central to this approach is fostering self-awareness and self-reflection to identify and address personal biases and privileges (Fisher-Borne et al., 2015;

Dewsbury, 2017). Straub (2023), from the Center for Research on Learning and Teaching (CRLT) at the University of Michigan, added that inclusive teaching “seeks to change the ways systemic inequities shape dynamics in teaching-learning spaces, affect individuals’ experiences of those spaces, and influence course and curriculum design.” With rising awareness of persistent inequities and an increased interest in broadening participation in STEM (National Science Foundation, 2023), a wave of PD has expanded across higher education and through STEM reform initiatives to train faculty in inclusive teaching strategies. The present study focuses on the Inclusive STEM Teaching Project (ISTP) as the context of our case study.

The ISTP

The Inclusive STEM Teaching Project (ISTP) is a six-week, self-paced asynchronous course designed to advance awareness and critical reflection of inclusive teaching concepts, confidence (i.e., self-efficacy) to implement inclusive teaching practices, and the creation of inclusive STEM learning environments. The course situates evidenced-based teaching and learning strategies within the concepts of identity, privilege, and positionality (e.g., Adams et al., 2007; Barnett, 2013; Yosso, 2005) to prepare faculty as inclusive instructors.

The ISTP course includes five modules: (1) Diversity, Equity and Inclusion (DEI) in Learning and Teaching in Higher Education, (2) Instructor Identity, (3) Student Identity, (4) Creating an Inclusive Course, and (5) Climate in the STEM Classroom. Course interactive components include embedded case-study videos, discussion-board prompts, facilitated synchronous local-learning communities (either in-person or virtual), facilitated affinity groups, and embedded reflection questions to help participants think about their current and future teaching practices. As of Fall 2024, 13,748 faculty, staff, postdocs, graduate students, and other learners from around the world had enrolled with 23% or 2,567 learners who have completed the course. Research and evaluation data have already demonstrated positive effects on program participants, especially in pre-post gains related to awareness, self-efficacy, and intent to implement what was learned (Calkins et al., 2024; Hill et al., 2025; Johnson-Ojeda et al., 2025).

The ISTP represents a robust, high-engagement program and was a prime candidate to recruit STEM faculty case study participants to examine how faculty members develop as inclusive instructors. Thus, this study is not an evaluation of the ISTP. Instead, the ISTP provided access to instructors who completed high engagement inclusive teaching development. Below, we review four categories of potential impact that can result from faculty development to inform our investigation of inclusive instructor development.

Faculty development impact

Faculty development has a rich history in higher education with numerous volumes dedicated to effective strategies that promote instructor growth and development. Faculty developers, evaluators, and researchers have focused on examining the impact of faculty PD to inform iterative cycles of ongoing improvement and increased beneficial effects for faculty and students (e.g., Fernandez and Audétat, 2019). Investigations of faculty development impact range from program evaluation informed by classical assessment framing (e.g., Kirkpatrick and Kirkpatrick, 2016) to more nuanced approaches that utilize specific theories such as adult learning (Merriam and Bierema,

2013). Despite varying approaches, it is possible to extract the major types of faculty development impact, which can provide insight into important developmental tracts that STEM faculty traverse as they advance in inclusive teaching. Below, four key areas of impact are explored, namely, cognitive, affective, confidence, and behavior. These domains were used to create a conceptual framework to frame the design of the study.

Cognitive

Participant awareness (or knowledge) of key concepts and strategies is one of the most common measures of faculty development impact. This is consistent with many studies and program evaluations of STEM interventions related to active learning (Macaluso et al., 2020), culturally responsive teaching (O'Leary et al., 2020), inclusive teaching (Schmid et al., 2016), guided-inquiry curriculum (Price et al., 2021), the preparation of future faculty in evidence-based teaching (Mathieu et al., 2020), and faculty learning communities (Brydges et al., 2013). The basic rationale is that faculty members must first be aware of what improved teaching strategies exist and why these pedagogies are more impactful for their students. From this perspective, cognitive growth must occur before faculty behaviors and actions can be effectively implemented. Following rational-focused conceptualizations of transformative learning theory (e.g., Mezirow, 1991) and metacognition (Dunlosky and Metcalfe, 2008), faculty members can reflect upon this new knowledge and awareness, compare it against older mental models, and shift how they think about their teaching, which prepares them to “try out” and implement new strategies in their classrooms. Thus, improved pedagogy, inclusive or more general, must appeal to the minds of STEM faculty members.

Affective

However, faculty members are not strictly rational beings. They possess multiple identities (e.g., race, gender, discipline, socioeconomic) and deep-rooted emotions, attitudes, and beliefs about teaching, learning, students, and even higher education, which influence their classroom behaviors. Researchers and practitioners have accounted for this fact by trying to capture shifts in attitudes and beliefs that result from engagement in faculty PD. Attempts at capturing affective outcomes manifest in studies of faculty adoption of evidence-based and student-centered teaching (Sansom et al., 2023; Shipley et al., 2023), institutional transformation (Favre et al., 2021), writing-based pedagogies (Finkenstaedt-Quinn et al., 2022), community college faculty (Parker et al., 2016), and faculty epistemological beliefs (Mataka et al., 2019). Often, affective-related outcomes are paired with other measures, such as self-efficacy (e.g., Fong et al., 2019) and teaching observations (e.g., Czajka and McConnell, 2019), to provide a more holistic picture of faculty development. Thus, affective measures complement other outcomes by providing a window into the heart and motivations.

Confidence

Self-efficacy, defined as one's confidence in their ability to perform certain actions (Bandura, 1977), merges the heart and mind of affective and cognitive domains. It is a common measure of programmatic impact due to its robust quantitative foundation and as a predictor of future behavior (De Vries et al., 1988), which is important given the costs of longitudinal assessment. For many

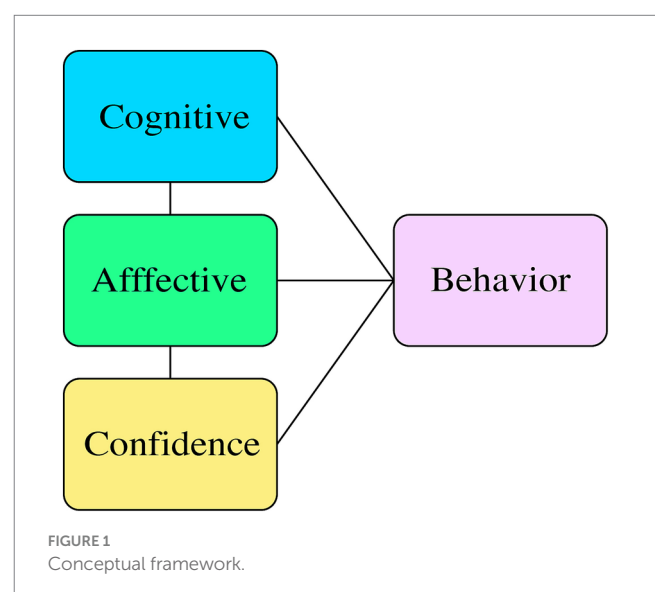
teaching development programs, it is by far easier to capture the likelihood of behavioral changes rather than following up with additional data collection and participant tracking. In STEM education, self-efficacy has been applied to graduate student development (Major and Dolly, 2003), small-scale program evaluation (e.g., Burton et al., 2005; Singh et al., 2013; Strickland-Davis et al., 2020), large-scale program evaluation (e.g., Mack and Winter, 2015), and longitudinal teaching development impact (Connolly et al., 2018; Derting et al., 2016). However, despite self-efficacy's prominence in examining the impact of faculty PD, it is also vital to record actual behavior outcomes.

Behavior

Measuring behavior has become a major feature of the program impact landscape. Observation protocols, due to the potential bias of faculty self-report data, have become the most common application of behavioral examination. The Reformed Teaching Observation Protocol (RTOP) (Czajka and McConnell, 2019; Manduca et al., 2017; Mataka et al., 2022) and Classroom Observation Protocol in Undergraduate STEM (COPUS) (Denaro et al., 2021; Kranzfelder et al., 2019; Smith et al., 2013) are two examples of protocols that have wide adoption and use. Others have developed observation protocols for more specific usages such as labs (Velasco et al., 2016), active learning strategies (Eddy et al., 2015), faculty peer observations (Sullivan et al., 2012), and self-observation (Garcia et al., 2017). While popular, observation protocols are not the only mechanism for understanding behavior impact. Other authors have explored self-reported changes in behavior through reflective prompts (e.g., Kennedy et al., 2021), interviews (e.g., Pelletreau et al., 2018), and surveys (Felder and Brent, 2010). In summary, what faculty do in their classrooms has been an increasingly important measure to investigate the impact of faculty development efforts.

Conceptual framework

The four elements described above constitute the lens by which we implemented our study. In Figure 1, cognitive, affective, and



confidence directly and/or indirectly influence faculty behaviors. In addition, cognitive, affective, and confidence elements are also connected and likely work in various combinations to influence and cause instructor behaviors. The cases described below attempt to illustrate the growth and development of STEM faculty who participated in a high-engagement inclusive teaching PD program. Each case, because of unique pre-requisite conditions entering the program and their experiences in the program, tells powerful stories of how STEM faculty members advanced within and across these elements. Thus, while simple, our conceptual framework provides scaffolding for each case to hang developmental change in inclusive teaching.

Methods

Study participants

The study presented here is part of a larger study investigating the impact of the ISTP. Course participants were invited to participate in the larger study through an IRB-approved consent form, which covered their course surveys (pre/post) and all the course content they generated in the edX platform. A sample of participants who completed the course ($n = 386$) from the June 2021 and Oct 2021 course runs were invited to participate in semi-structured interviews. Participants from non-white majority populations (i.e., excluding white men and white women) and non-research, non-primarily white universities were purposely over-sampled to attempt an interview dataset with diverse participants ($n = 80$). This resulted in 23% individuals who were not white, 20% that were men, 20% that were from Comprehensive or Regional Universities, 30% from Liberal Arts institutions, and 6% from community colleges. White women were overrepresented among interviewees (60%).

All interviewees were invited to participate in the case study component to increase participant diversity as much as possible. Twelve individuals originally agreed to participate and completed the case study IRB-approved consent form. Three case study participants dropped out of the study, leaving nine participants who provided the full case study dataset as described below. Table 1 describes the case study participant characteristics in more detail.

Data collection

We collected eight kinds of data for the nine case study participants, resulting in large comprehensive datasets. Table 2 describes each data source and when it was collected over 12 months. The ISTP course surveys included four validated scales (Johnson-Ojeda et al., 2025) **awareness** of inclusive teaching strategies, practices, and principles (pre and post); **confidence** to implement inclusive teaching practices (pre and post), likelihood to **implement** the same practices (post), and extent of **reflection** on inclusive teaching (post). The inclusive teaching practices items used in the pre- and post-course observation survey was a combination of items from a survey developed [blinded] and the course pre-post surveys. For course observations, we instructed faculty members to set up a camera in the back of the room to record their teaching and interaction with students for 2–3 course sessions. Case study participants then uploaded each recording to a secure, individualized Box folder. We also collected pre- and post-survey instruments from the students in the observed classrooms, although the response rates were not sufficient to include in our analysis. Initial and final interviews consisted of semi-structured questions that lasted approximately 45–60 min. All interviews were transcribed verbatim.

Data analysis

Following best practices for case study design (Yin, 2017), we combined all data sources for each participant into single documents to gain a global perspective and to simplify data analysis. We divided the analysis into three phases. In **phase 1**, each research team member ($n = 3$) reviewed a single case, paying attention to how instructors changed over time in their inclusive teaching and the similarities and differences between participants. Our goal was not detailed coding at this stage, but to capture the stories of the three participants, which resulted in short case summaries. We met multiple times to discuss the intricacies and nuances of our respective participant stories to (1) establish a strong foundation for interrater reliability, (2) begin to identify cross-case themes, (3) examine how data sources interacted, and (4) discuss how to effectively extract complex stories from each case.

TABLE 1 Case study participants (pseudonyms).

Name	Race and gender	Institution type	Discipline	Course observed	Teaching role %	Years teaching
Katz	White Woman	Comprehensive	Chemistry	Introductory Chemistry (60 students)	70%	10
*Curry	White Woman	Research	Chemistry	Introductory Chemistry (150 students)	No response	1
*George	White Man	Research	Mathematics	Upper Division Statistics (45 students)	40%	4
Leland	White Woman	Liberal Arts	Earth Science	Introductory Earth Science (20 students)	60%	8
*Miller	White Woman	Comprehensive	Biology	Upper Division Microbiology (50 students)	50%	4
Milo	White Woman	Research	Biology	Sophomore Forensics (15 students)	90%	30
*Patton	White Woman	Research	Engineering	Upper Division Engineering (40 students)	50%	22
Ralston	White Woman	Research	Engineering	Upper Division Food Science (30 students)	60%	10
Smith	White Man	Liberal Arts	Chemistry	Introductory Chemistry (30 students)	45%	27

*Identified as a first-generation college student.

*Identified as LBGTQ.

TABLE 2 Summary of data sources.

Data source	Description	Timeline
Pre-course survey	Participant characteristics (e.g., role, institution type, discipline, race/ethnicity, gender identity), prior teaching and DEI-related PD, teaching experience, and two quantitative scales (awareness [not at all aware, slightly aware, somewhat aware, aware, very aware, extremely aware], confidence [not at all confidence, slightly confident, somewhat confident, confident, very confident, extremely confident])	Beginning of the ISTP
Post-course survey	Four scales, all 6 pt. (awareness , confidence , likely to implement [not at all, a little, somewhat, moderately, very, extremely], and extent of reflection [not at all, a little, somewhat, moderately, very, extremely])	Immediately after the last ISTP module
Course reflection prompts	Prompts to explore course content, their current teaching strategies, and plans for future implementation.	During the ISTP modules
Initial interview	Participant ISTP experiences, ISTP' impact, and the implementation of inclusive teaching practices.	3–6 months after the ISTP course
Pre-course observation survey	Inclusive teaching plans, ISTP learning integration into their teaching, and the likelihood to implement inclusive teaching practices [not at all, a little, somewhat, moderately, very, extremely] during the course.	1–2 weeks before the course being observed began (semester following their interview)
Faculty observations	We conducted 2–3 course session observations using the Opal Protocol for Active Learning (OPAL) (Frey et al., 2016; Solomon et al., 2018).	Spread out over the course
Post-course observation survey	Same as the pre-instrument except they were asked the extent that they implemented the inclusive teaching behaviors.	At the end of the course being observed
Final interview	Questions explored and debriefed their teaching experience, inclusive strategies used, and plans for future courses.	Within 1–2 weeks of the course ending

During **phase 2**, one researcher reviewed the remaining six cases and created short case summaries to capture the “big” picture of each respondent, which all researchers reviewed and discussed. One of the researchers also conducted all course observation analyses of the video files using a pre-established process (Frey et al., 2016; Solomon et al., 2018), namely, the OPAL (Observation Protocol for Active Learning). Like the Teaching Dimensions Observation Protocol (TDOP; Hora, 2013), OPAL provides descriptive rather than evaluative feedback. OPAL includes behavior codes for both instructor and student, such as *lecturing*, *group work*, and *discussion follow-up*. During each 2-min interval, the observer marks the presence of specific behavior using occurrence sampling. All OPAL codes are recorded as nominal-level data, meaning behaviors are recorded as either occurring or not within each interval. A few codes, such as *posing or answering questions verbally*, are also recorded as ratio-level data, with the observers tallying the number of occurrences within each 2-min interval. The results of the observations, which included elements such as classroom layout, the number of questions posed by students and the instructor, the extent of student engagement, and pedagogical methods, were added to the combined case data files in the form of a summary result paragraph. The research team then met multiple times to discuss and reach agreement concerning the intricacies and nuances of each case, paying close attention to cross-case themes and sub-themes that were emerging, the interaction of data sources, which now included observation results, and the “stories” of the case study participants.

Finally, in **phase 3**, researchers each took three cases and extracted, from the combined data files, any mention of the types of potential impact related to our conceptual framework (i.e., cognitive, affective, confidence, and behavior) and organized them in temporal order to allow the examination of change over time. We then revised each case summary to better relate participant stories of their inclusive teaching development within the areas of our conceptual framework and reviewed each other's analyses to check for areas of (dis)agreement. During team

meetings, we discussed and addressed areas of disagreement, revised the case summaries as needed, solidified cross-case themes, and identified the unique aspects of individual case “stories.”

Results

Due to length limitations, we provide only four detailed cases organized by our conceptual framework. Through our analysis, and congruent with existing research (Dewsbury, 2020), it was strongly apparent that participants' identities factored heavily into their development as inclusive instructors. Thus, we have included identity as an additional section for each case. The discussion section will present three important cross-case themes from all nine participants. Please refer to Table 1 for additional descriptors of case participants.

Early career: Professor George

Professor George was an early career Mathematics faculty member at a research university who taught mainly statistics and had a 40% teaching appointment. The course we observed was an upper-division statistics class with 45 students. Before the ISTP, he engaged in moderate amounts of teaching PD, minimal formal diversity, equity, and inclusion (DEI) training, and modest informal DEI training. He was motivated to participate in the course to improve his knowledge of teaching, learning, and DEI topics to improve his teaching skills.

Identity

Professor George deeply reflected upon his identity as a gay, white man during the ISTP. For example, he said, “I often suppress or move that aspect of myself to the background...Presenting as a cis, white, male with a PhD makes it easier for my students to accept what I say

than if I was a woman or a person of color.” He realized that this framing could have negative connotations for his students. He questioned “why I continue to leave part of myself (being a gay man) outside the classroom/office...how can I expect students to feel fully welcomed in the classroom when I’m leaving part of myself outside?” He engaged with this difficult question during the ISTP though he still felt “uncomfortable...[due to] fear of homophobic reactions” in the final course reflection. The course caused him to examine how his own identities manifest in the classroom and related student impact.

Cognitive

During the ISTP, Professor George mentioned in a reflection that previously, he had “a passing awareness of issues surrounding DEI, but it always seemed removed from the realm of mathematics/statistics.” Survey data demonstrated increased awareness of inclusive practices and principles with all pre-course measures (means) at $m = 2$ or 3 (6 pt. scale) and all post-measures reported at $m = 4$. Yet, in contrast, in his interview after the ISTP, he stated, “I did not necessarily have a lot of growth in awareness,” and then went on to explain that he had “a K–12 background and so the notion of inclusivity has been part of my DNA as a teacher.” Where awareness increased was in a confirmatory sense. He explained, “seeing the videos talking about the same things that I’ve been thinking about and doing myself was like, I’m not alone...there are other people who see value in those strategies.”

Affective

Early in the ISTP, he commented that he taught his courses in “a discussion-centered way,” and for that approach to be successful, he needed “to do what I can to help establish and maintain an environment in which all students feel welcome and safe to participate as themselves.” He wanted to become a more inclusive teacher, “supporting my students to build an inclusive classroom environment with me.” He maintained a consistent disposition in that “I’ve always felt that I play a key role in shaping and maintaining an inclusive classroom,” though he enhanced this resolve in two major ways. First, how he defined inclusive teaching evolved because of the course. He elaborated, “inclusive teaching means more than just making sure that I establish a welcoming environment...it has expanded to...actively engage the hard conversations...incidents and experiences that students bring with them in respectful ways.”

Second, he became more empowered to implement inclusive practices since he had the “freedom to make changes about content and concept presentation.” Overall, Professor George’s affective domain was enhanced because of the ISTP.

Confidence

Survey data indicated that he reported no pre-post change for seven (of 19) of the confidence items, seven items in which he increased by 1 pt. (on a 6 pt. scale), and three where he increased by 2 pts., such as *obtaining feedback about the course climate from my students* and *use feedback about course climate to improve student learning*. These mixed gains may be a result of conflation with becoming “more confident in many of the things I was already doing.” In addition, since COVID-19 shaped much of their early higher education teaching career, he indicated that his confidence overall was bolstered by knowing that faculty at many institutions cared about and were doing the same things. Thus, as his awareness increased, his

confidence growth was more confirmatory than acquiring confidence in new teaching methods.

Behavior

The major behavioral theme for Professor George was his desire for increased student ownership. During the ISTP, he discussed plans to have “students take on a more active role in the construction of the course syllabus and policies,” which he felt would lead to an improved class community. In his first interview, after he implemented inclusive strategies in one of his courses, he discussed giving “more control over to my students... [which] was something I have not done before.” He continued and refined this practice in the course that was observed. He explained, “I attempted to get students more involved in setting course policies both in generating the ideas and the voting on those ideas.” This instructional strategy “was very useful in...making sure that everyone had some input [where] students do not normally get to have input and power in that way.”

He planned two additional inclusive strategies and then implemented them, as supported by observation data. First, he planned to “give a more open self-introduction and provide students an opportunity to share what they feel comfortable sharing.” He then discussed implementing “a ‘get to know you’ introduction assignment that had some general questions about the students. I [got] to know them, and I shared my answers to those same questions.” He also collected his students’ favorite songs and organized them into a playlist to get to know them better, which he then shared with the entire class. Second, he wrestled with student assessment and considered “creating more space for students to choose how they can demonstrate their understandings” while balancing the need to still “measure what I need to measure” while not “burying myself under a mountain of work.” In practice, he implemented a system by which students would grab and display one of three cups (green, yellow, or red) to demonstrate how they felt about their understanding of the material, which was well received by the students and provided useful formative feedback.

Summary

Professor George, as an early career faculty member with prior K–12 teaching experience, strengthened cognitive, affective, and confidence domains by enhancing and confirming prior efforts. This led to productive internal dialogue about how aspects of his identity manifest in the classroom and changes to his classroom instruction.

Late career: Professor Katz

Professor Katz was a late-career white woman and a full-time lecturer with 10 years of teaching experience at a comprehensive university with a 70% teaching appointment. She taught introductory chemistry to 60 students and worked as a scientist in industry before transitioning to academia. As a result, she did not identify as an academic. Before the ISTP, she engaged in a moderate amount of PD workshops related to DEI. She participated in the course because she saw the broad importance of DEI.

Identity

Professor Katz indicated a strong awareness of her “White, hetero, highly educated” identity, which she believed was perceived as

“off-putting” to many of her students who “did not have the same [educational] access” growing up. However, during the ISTP, she placed some of the burden in overcoming the lack of approachability on her students. She elaborated, “I believe [my white] identity...is quite limiting when trying to relate to a minority student, especially those with little confidence...I believe their performance would improve if they believed I was more approachable.” An ISTP activity that had participants reflect upon the meaning and story of their name was effective in helping her more deeply acknowledge her identity in relation to marginalized individuals. She referred to herself as someone who “got involved in diversity issues” because of “being a young white woman [in a] predominantly older white male [cooperate] environment...[and] felt the marginalization of being a woman in a man’s world.” She continued to experience this marginalization at her university, citing how men are referred to as Dr. whereas students use her first name or use “Ms.” Thus, the ISTP course helped her more deeply reflect on her identity and past experiences with marginalization.

Cognitive

Qualitative data for Professor Katz revealed little about her cognitive development. Quantitative data (see Table 2 for scale labels) demonstrated that she was marginally aware of inclusive teaching strategies and principles as indicated by the pre-course survey, which revealed pre-measure means of either $m = 2$ or $m = 3$ (6 pt. scale). Her awareness mostly improved by the end of the program. Post-course awareness measure means were either $m = 4$ or $m = 5$ except for one item (i.e., *awareness of the kinds of challenges students holding minoritized identities might experience while navigating teaching and learning spaces*), which was the same for both pre- and post-measures ($m = 3$). Like Professor George, she seemed very aware of the privileges that came with her identity. She tried to “create a classroom environment which does not favor the privileged at the expense of the rest of the students” and was acutely “aware that on first impression, I present the face of white privilege.”

Affective

The embodied student case study videos in the ISTP helped her see that it is hard for some students to speak up for and believe in themselves. She reflected on one of these videos, stating “[the student] internalized the false idea that college was not for people like her. It weighed her down and created a negative narrative...until she heard the words suggesting someone believed in her.” This video caused Professor Katz to reflect on her students and the lack of confidence she had observed. She recounted, “[My] students arrive with widely varying backgrounds and capabilities...there is a group of students who could be more successful if they had a bit more confidence, saw themselves as capable, and felt as if they belonged.” She then discussed how she believed her attitude toward inclusive teaching had shifted, “I’m more willing to believe that some of these kids can be redeemed...they can actually make it early on...it’s not the subject matter, it’s their ability to have confidence in themselves.” Despite her seemingly genuine care for the student experience, she at times failed to support a growth mindset (Limeri et al., 2020). For instance, she said, “often I see minority students expressing goals which seem out of line with their abilities in my class.” She continued, “the students I have the most difficulty with come into the class with little or no preparation. Some, I believe, are not even ready for college, much less a fast-paced natural science course.” This was tied to her beliefs that, “the quality of

students coming [from K12] is declining...which is a frustration that has nothing to do with inclusivity.” Thus, despite affective growth, Professor Katz presented as a faculty member who was still working through dissonant beliefs.

Confidence

Professor Katz gained confidence in her knowledge and awareness of inclusion concepts, which encouraged implementation. She explained, “I do not feel competent in the sense of teaching-level competence, but I feel comfortable with the concepts,” which still encouraged her to make changes to her course. Survey data showed that Professor Katz reported pre-post change for all but two (of 19) confidence items. She scored $m = 2$ or 3 in all pre-measures and mostly $m = 4$ or 5 in post-measures. There were two areas where Professor Katz reported no confidence growth, such as *using feedback about course climate to improve student learning*.

Behavior

Professor Katz reported implementing multiple inclusive strategies. For instance, she planned to become more aware and mitigate the impact of implicit bias by giving a more thorough introduction of herself and allowing the students to get to know each other better in small groups. She also added the institution’s DEI statement to her syllabus and provided additional information about her office hours. She held an open discussion about what else the students would like to know about her/the course, made lecture recordings accessible, and implemented clicker technology.

However, while she talked a lot about her plans for inclusive teaching, there was some dissonance in implementation. The pre-course observation survey demonstrated that she recorded a high likelihood to implement all 31 pre-measure items (all $m = 5$, 6 pt. scale), but post-measures reported 18 items that scored $m = 1$ –3. In addition, while she verbalized interest in inclusive teaching, class observation showed minimal student engagement during class and a somewhat robotic nature of course content delivery. She stayed at the front of the podium for the duration of the entire lecture and provided little to no time for student questions. Therefore, despite strong attitudinal support for inclusivity, her observed behavior did not seem to necessarily translate into a welcoming student course experience. This does not diminish her effort to teach inclusively; instead, it captures an early stage of inclusive teaching development.

Summary

Professor Katz expressed a sincere desire to use inclusive teaching practices to improve student experiences. Yet, there was lingering dissonance between what she planned to do and what occurred. Her class observation did not showcase any student interaction and/or engagement during her lecture. She grew in awareness of her own identity and positionality but retained at least some remnants of more traditional perspectives of students and pedagogy. Thus, she was an example of an instructor who was making significant strides forward and possessed a strong intent to continue learning.

First-year: Professor Curry

Professor Curry was a first-year faculty member at a research university who taught introductory chemistry to 150 students in three

sections. She identified as a white, queer, disabled woman. She indicated that she had participated in a modest amount of informal and formal workshops related to DEI, suggesting at least some prior knowledge. Her motivations for taking the ISTP were to increase knowledge, enhance teaching skills, and find colleagues interested in inclusive STEM teaching.

Identity

She recognized her privilege as a white woman but also the tenuous aspects of other parts of her identity. For instance, she said, “I’m most aware of my whiteness, disability, and gender identity. My whiteness grants me credibility that my colleagues of color are not extended. I feel acutely scrutinized as a disabled person.” She also experienced anxiety, “about the notions of authority...will students take me seriously? Will my white racial identity prevent me from forming close relationships with my students?” She felt a strong need for “students to feel safe, connected, and vulnerable in my classroom.” To build rapport with her students and to encourage them to bring their full identities into the classroom, she “introduced [herself] by situating [herself] socially, as a white, queer, disabled woman... [which was] surprising to many of them, because many of their teachers do not kind of share those aspects of their identity.” She tried to center identity within the learning environment of her classroom to help her students connect meaningfully to each other and the content. She discussed how the ISTP “strengthened the identity that I already held of being a teacher-scholar.” She elaborated, “[the course] really entangled my identity as a chemist and a researcher with my identity as an educator...[it] solidified my identity as a teacher-scholar and how important it is to be an inclusive and accessible educator.” Thus, identity played a central role in Professor Curry’s development as an inclusive instructor.

Cognitive

The pre-course survey demonstrated that she was already aware with many of the inclusive practices and concepts with most items ranging from $m = 3$ to 5 (6 pt. scale), which was supported by her first interview where she said, “I went in...on board with the idea that being an inclusive teacher is like a foundational principle that I hold as an educator.” Post-survey results showed mostly one-point gains with only three items increasing by two, such as *common challenges instructors can face when incorporating inclusive practices into their teaching* and *inclusive course design practices that reduce barriers to student learning*. During the ISTP, she wrote about the importance of her awareness as an instructor. She explained, “awareness is a really critical component, so I commit to reflecting honestly and often about my thoughts, and identifying patterns of thinking that originate from a place of bias.” In the final interview, she detailed how the ISTP impacted and affected her awareness of inclusive teaching and learning. She said, “[the course] strengthened my view of how important [inclusive teaching] is...I already thought it was important...[but now I know]...what I was doing mattered.” Thus, like Professor George, the course served to strengthen and confirm her knowledge of inclusive teaching.

Affective

The data consistently showed that she strove to create a safe and brave environment for students to thrive. Even though it was her first year of teaching, she revealed deep intentionality in assignment creation, integrating student learning, and valuing inclusive language.

She called students “scientists” or “researchers” to aid in a sense of belonging to the science community and shared her personal experiences. She explained, “As a disabled person, I bring navigational capital. I am very good at finding solutions to problems with limited resources and being open-minded about how tasks can be accomplished.” With this deeper understanding, she held herself accountable for an inclusive classroom and worked to ensure that no “-isms” and biases were tolerated by herself or students. Overall, she was deeply committed to inclusive teaching, and participation in the ISTP strengthened that resolve.

Confidence

Professor Curry entered the ISTP with high confidence in most of the items in the pre-survey with 14 (of 17) receiving fives and one item a six (6 pt. scale). All the fives turned to sixes in the post-survey, and the two increased by one or two points. In interviews, she further described how her confidence increased. First, she recounted that the course “really made me confident that what I was doing was the right thing that aligns most closely with my values as a person and as an educator.” Second, it “situated me within a community of other people who felt that way, so I did not feel like I was alone.” Lastly, the course “gave me more skills and a larger toolkit...[and] increased my confidence that I would be able to do the things that I find valuable.” In her final interview, she expanded on the “evidence-based confidence” she gained because the course “gave me the confidence that I needed to actually implement the different strategies because I knew that they were evidence-based.” Thus, while already confident coming into the ISTP, she still increased her confidence to continue in inclusive teaching.

Behavior

She implemented several inclusive teaching practices such as the use of inclusive language, embedded accommodations for students, “explicit opportunities to reflect on learning and on scientific identity development,” personal vulnerability, identity-related extra credit assignments, and “restructuring of the grading system to deemphasize exams.” She had well-attended office hours because she purposely made connections with her students. If students did not show up to class after a few sessions, she reached out to them, which, considering the number of students in her three sections of introductory chemistry, was no small matter.

When she started teaching, she turned to colleagues at her institution to examine what was and was not working. However, she discovered that her peers were not doing much concerning inclusive teaching. The ISTP became a community for her to identify strategies, gain feedback, and be “surprised or challenged on some of my thoughts and beliefs.”

She became “really interested to learn about how students who have different identities experience learning in our department, and with different professors.” She mentioned wanting to collect data so that she can “approach my colleagues to try and create more meaningful change across [the department].” Thus, her zeal for inclusive practices implementation turned outward to her department, as with Professor Milo described below.

Summary

Professor Curry demonstrated growth in all conceptual framework elements and demonstrated their interconnected

nature. Her awareness, attitudes, and confidence were intertwined with her identity and passion for inclusive practices. Class observations validated her willingness to implement through her openness about her own identities with students as well as inclusive language that prompted an influx of student participation. Her mindfulness was key in the selection and execution of inclusive teaching strategies.

Late career: Professor Milo

Professor Milo was a non-tenure track biology faculty member at a predominantly white research institution, where she spent most of her time teaching (90%) “rural first-gen white students from disadvantaged socioeconomic groups.” Milo taught a forensic course to 15 students and identified as a white woman who had been teaching for 30 years. Before the ISTP, she engaged in multiple years of both formal and informal PD activities related to DEI. She was motivated to take the ISTP because she wanted “to learn to create spaces where I am more effective at balancing the need to avoid any re-traumatization of minoritized students while encouraging white students to truly examine their positions.”

Identity

She was “very aware of my privileged position as a ‘continuing generation’ white woman in my department...It confers on me an advantage that I have worked very hard to overcome, as it took...time to recognize the unwritten or hidden curriculum.” She was also a long-term, non-tenure track teaching faculty who had faced significant discrimination. She recounted that non-tenure-track faculty in her department were “viewed as interchangeable, punished by reduced teaching loads if we objected to assignments that were unreasonable,” which led her to “withdraw...[from] faculty meetings or social gatherings.” A poor departmental climate led her to pursue additional identities beyond her original science training. “My newest identity is that I shifted from basic biology research to the Scholarship of Teaching and Learning (SoTL), including going back to graduate school and getting a master’s in education.” This experience “increased the distance between myself and [fellow faculty], as many of them perceive my research interests as ‘not really research.’” Yet, she noted several benefits for her students since it grew her “knowledge and practice of inclusive teaching...allowing me to be more vulnerable, to create opportunities for them to become experts and to teach their peers.” Her identities helped shape her development as an inclusive instructor by bolstering the need for inclusivity amidst marginalization within a white-dominant STEM culture.

Cognitive

Of the 18 awareness items in the pre-course survey, Milo recorded a five or six on the 6 pt. Likert scale on 50% of them. At the start of the ISTP, she was least aware of items related to identity (e.g., *How student identity can impact student learning* [$m = 2$]; *How perceived instructor identity can impact student learning* [$m = 3$]). The largest gains in awareness consisted of the same identity-related items. However, when asked about awareness gains in the first interview, she responded that there was “very little” since she and her colleagues who took the course were “waiting for the next-gen practices and...we are a little bit disappointed, [we were] very experienced in active learning...the

course was not really designed for us.” Thus, she did not report cognitive increases as she was already quite versed in both active and inclusive teaching. However, as shown below, there was still growth as an inclusive instructor, though it manifested differently than in the other cases.

Affective

She did not report any transformative changes concerning the affective domain. She entered the ISTP with a deep desire to advance inclusivity in undergraduate STEM education both in her classroom and among her more traditional colleagues. For her, the ISTP did not create her passion for inclusivity. Taking the course was “very confirming, it was like, yes, the data really do support what I do.” Yet, at the same time, there was a tension in wanting to positively influence her colleagues since, “I just had to reach the conclusion that I’m not going to change anyone else.” She went on to say, “I’m struggling to not feel judged by my peers who refuse to do it. And I recognize that they are feeling judged because I do it.”

Although there were no major shifts in attitudes and beliefs, Milo did evolve in her thinking regarding the accumulation of teaching “tricks” by engaging the ISTP student case videos, which she “had never seen anything like that before...[and] were amazingly effective.” She recounted that often, “I’m looking for the pedagogical trick...that will create learning for students who are struggling. And I love that success [in the video] was fostered and supported not by curricular structures and pedagogical ‘tricks’ but by simple human support.” Overall, despite her prior DEI training, she still made progress in the affective domain by confirming her prior beliefs and providing new insights into the importance of human support.

Confidence

In the pre-course survey, she recorded all fours or fives (6 pt. scale) for all confidence items. Post measures were mostly sixes with a few fives. She increased two points for five items (from $m = 4$ to $m = 6$), such as (1) *using feedback about course climate to improve student learning* and (2) *striving to address any gaps in my knowledge and understanding of how inclusive teaching can impact student learning*. However, despite some quantitative gains, she indicated in her first interview that “I do not think my confidence changed from the course to be perfectly blunt.” Yet, in the final interview, she reported increasing confidence in “soliciting student feedback and [their] ability to advocate for inclusive teaching.” Regarding the second area, she explained, “I’m feeling a lot more confident. I am feeling a lot more willing to call people out on their BS...the ISTP really made me feel like I can speak up.” It is important to note that she changed how she perceived changes in her confidence as she reflected upon her ISTP impact. This demonstrates the need for longitudinal data collection in understanding inclusive instructor development.

Behavior

With her prior experience, it was no surprise that she already implemented inclusive practices before the ISTP. In her first interview, she mentioned, “I’m always trying new things out in my room, but none of them are things that I pulled from the [ISTP].” However, in her final interview, she recounted two key changes she made because of the ISTP. First, she indicated advancing more inclusive course material, such as creating “skeletal identification questions in a more transparently critical fashion.” Second, she indicated that the “biggest

strategy I adopted from ISTP was increased opportunities for feedback from students, implemented as ‘check in’ and ‘check out’ assignments.” The ISTP gave “me the freedom to evaluate and replace one assessment strategy [i.e., iClicker] with another,” which has “been amazingly fruitful in terms of allowing me to assess what students really want to know each week.” Class observations confirmed that she collected student feedback and involved her students in assessment and content coverage areas, demonstrating that she had a relationship with her students and the students seemed comfortable.

Summary

Overall, Professor Milo was a case of someone already familiar with inclusive teaching before the ISTP who still progressed on their inclusive teaching journey. Even though she gained practical pedagogical behaviors, the major takeaway was her increase in both the affective and confidence dimensions in speaking up about inclusivity on campus and with her colleagues. This suggests a progression of internal growth to outward manifestations.

Discussion

Before we discuss our results, it is important to note that our study participants were all committed to inclusive teaching and were willing to participate in all stages of the study. This is not necessarily a limitation, yet it presents an important boundary line in interpreting a specific group of faculty members’ experiences in learning to teach inclusively (i.e., those who already started their journey to become inclusive instructors). With that in mind, study results indicated three cross-case themes: (1) the importance of identity, (2) iterative development, and (3) barriers to inclusive teaching. We discuss each and then present a revised conceptual framework.

The importance of identity

In medical education, authors have examined how PD can aid in the formation of an educational or academic identity (e.g., O’Sullivan et al., 2021; Steinert et al., 2019). Other scholars have likewise explored the intersection of identity and faculty development (e.g., Costino, 2018; Sturtevant and Wheeler, 2019) and how identity (albeit professionally focused) is central to the process of socialization to disciplines and the professoriate (Austin and McDaniels, 2006). While important, the “professional” facet is but one of the many identities faculty members carry with them into teaching settings. All study participants deeply reflected on the identities they bring into the classroom. While not as common as other faculty development impact factors indicated in our conceptual framework, identity was confirmed to be a critical component of inclusive teaching development (Dewsbury, 2020). Like cognitive, affective, and confidence dimensions, the identities of case study participants informed their behavioral outcomes by examining and reflecting upon their unique identities and the associated impact on their student engagement practices. For instance, Professor Leland gained “confidence in being aware of and being able to identify how my identity shapes my experience of the classroom, climate, and the student interactions I may have.” Professor Ralston noted that “being a woman in engineering has both helped (allowed for many female students to

bond with me quickly) and hurt (some students do not trust my expertise or respect my authority as much).” Professor Smith shared that being “a member of the white male power structure, I have no trouble establishing my credibility... can get by with making mistakes and maintain a level of respect.” In contrast, Professor Patton explained that, “I will never, ever fit in - not in academia, not in the suburbs, not in my family. I’m a first gen college student from a disadvantaged neighborhood.” Her perspective made her “more than willing to listen to students, particularly female students, who are struggling with feelings of belonging.” Because she struggled with “ADHD, depression, and anxiety, I can sympathize with students who suffer from similar issues.”

For all case study participants, the awareness and examination of their own identities were paramount in their development as inclusive instructors. Developing as an inclusive teacher is not simply the accumulation of knowledge, confidence, and evolving affective domains. It is tied to the very essence of an instructor’s identity, which is no longer constrained by academic objectivism that creates a “safe” distance between teacher and learner. To become an inclusive instructor, one must embrace the heart of a teacher (Palmer, 2017) and understand themselves, their students, and how the two weave together to form unique learning environments. Identity is the central nervous system that connects cognitive, affective, and confidence growth that then produces inclusive teaching behaviors. As summarized by Professor Leland, “This idea that you are bringing your identity into the class...let us see that as something that’s an asset that we work with, as opposed to pretending that we can just turn that off.”

Iterative development

Study participants all had at least some prior inclusive teaching experience. Yet, regardless of prior experience and career stage, each participant reported inclusive instruction advancements. Professor Milo, arguably the most knowledgeable of inclusive teaching of the case study participants, gained new inclusive teaching strategies, continued to experiment and improve her instruction, and became more comfortable in engaging her campus constituents. Other instructors had important perspective shifts, such as Professor Patton noting that “I always knew I could set a tone, but I do not think I realized how much it is incumbent upon me to create the climate.” She went on to say that the ISTP “definitely opened my eyes to how much identity and sense of belonging can impact the learning environment,” and recounted that “I made the mistake of thinking that if the students had been admitted to this college there was sort of an even playing [field].” Many study participants indicated that the ISTP helped confirm, enhance, and assure their inclusive teaching beliefs and behaviors because the ISTP “slows you down to question what you have been doing and whether you know whether you are doing it the most effectively.” As indicated by Professor Miller, “there is always more work to be done in this space,” which presented participants with a challenge and opportunity for ongoing growth, which, as indicated above, directly engaged their core identities. For study participants, developing as an inclusive instructor was not a destination but rather a journey, which pushes beyond views of instructional development as the acquisition of “tips and tricks,” or even the application of scholarly methodologies for teaching

improvement. This does not mean that inclusive teaching development runs orthogonal to existing faculty development practices and standards. However, our study does demonstrate and confirm that inclusive teaching development deeply involves the rational and the emotional, the identities of instructors and students, and the swirl of the heart, mind, and behaviors (Dewsbury, 2020). Inclusive instructional development is dynamic and continues to evolve, which implies that PD opportunities should focus not just on best practices but more holistically provide a path for and encourage a culture of ongoing iterative development that looks inwards and outwards.

Barriers to inclusive teaching

Study participants taught within unique institutional contexts, which helped and/or hindered their inclusive teaching practices. For instance, most participants discussed how even their students could be barriers to their inclusive teaching efforts, which was manifested through resistance to teaching methods to which they were not accustomed, the lack of preparation for college, absenteeism, and an unwillingness to engage beyond the bare minimum. Professor Milo even mentioned that she had “students go into full rebellion and mount letter writing campaigns to a dean, saying that I should never be allowed to teach because I’m not teaching, I’m asking them to teach themselves.” Participants also struggled with balancing “high expectations” for courses and helping all students succeed, especially when summative course assessments (and even syllabi) were rigidly set by the department. Some participants, who were not on the tenure track, felt like they were walking a tightrope because “I do worry about how my own evaluations and job could be impacted...students with privilege and power would be the ones more likely to lodge significant complaints that could hinder my professional life.” Some expressed frustrations with class size, classroom spaces, content, and even having sufficient time to implement inclusive practices, which presented logistical challenges. Others felt isolated in their departments since their “voice was the only one telling [their students about inclusivity] in their major...so while they may hear me, they are also being told the opposite in other spaces.” Most participants mentioned at least some type of departmental power dynamics or cultural barriers that influenced their inclusive teaching efforts. For example, one instructor highlighted outdated and persistent teaching practices of their older colleagues, though they were optimistic in sharing inclusive practices and that “even if they just do one or two things, they steal one or two things from me to incorporate that will already make a difference.” Others faced more significant pushback from colleagues where “because their field was founded by dead white men, they did not need to consider or talk about DEI in their classroom.” Another participant encountered the positivist culture of STEM and the “white, heteronormative climate” that it perpetuates. Overall, while there was a range of intensities related to challenges, all case study participants encountered at least some barriers to their inclusive teaching efforts. Thus, despite iterative and ongoing development, becoming inclusive instructors requires that faculty acknowledge and learn to work within different barriers that contextualize inclusive instruction.

Beyond the barriers mentioned in our study, it is also necessary to briefly speak to the recent changes in the political landscape that have put diversity, equity, and inclusion (DEI) under attack. Future research will be required to fully investigate the impact of these changes on

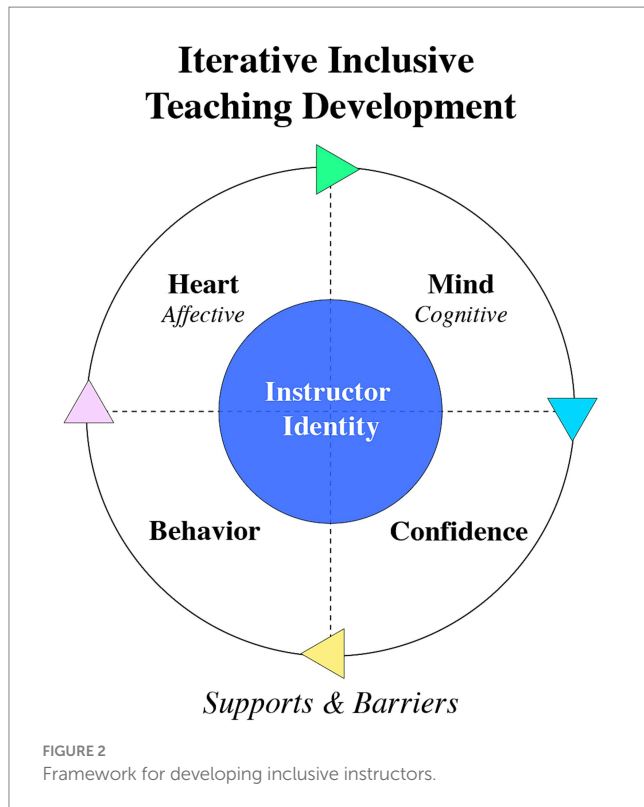
inclusive instructor development. Faculty within this environment are and will be faced with increased scrutiny over the words they use and the decisions they make regarding pedagogy. Despite these challenges, we argue that learning to become inclusive instructors is even more important now, especially in raising awareness for and communicating the benefits of inclusive teaching to various higher education constituents. Inclusive teaching is often framed on the surface as solely an approach to support underrepresented students to succeed in college. Yet, inclusive teaching is, at its heart, a pedagogical mindset and approach that accounts for the intersection between the identities of instructors and the students who are present in each unique teaching and learning context. Thus, an inclusive instructor is someone who can work to meet the learning needs of all their students dynamically by adjusting their teaching and being mindful of classroom dynamics that can be detrimental to students from both majority and minority populations. Not surprisingly, the key results of this study can become critical elements in creating the antecedents for productive dialogue across differing perspectives on inclusive teaching and even DEI. The tenants of inclusive teaching are not the antithesis to anti-DEI policies; instead, we argue that they can be used to help create an antidote to bring differing perspectives to the table to advance undergraduate education that advances individual, workforce, and national priorities. Thus, faculty, as inclusive instructors, can be key agents of change for collective higher education goals.

A framework for developing inclusive instructors

Based on our results, we present a framework (see [Figure 2](#)) for developing inclusive instructors in higher education. Both supports (although not emphasized above) and barriers contextualize the development process, existing at both individual and organizational levels. Instructor identity is at the heart of the framework, implying the need to pay attention to the identities of instructors in creating PD offerings and to help instructors examine how their identities interact with their teaching and learning environments. Circling identity, we have placed heart, mind, confidence, and behavior, which are different but interrelated facets of inclusive teaching development that continue to evolve and mature over time in different combinations, emphases, and intensities. The order of these four variables is not intended to infer a sequence of development but rather three-dimensional movement in which they can be independent and dependent on one another as they circle and even interact with instructor identities. Faculty developers and instructors can use the framework to design PD opportunities that bolster each of the six components to promote ongoing, iterative growth.

Limitations

Admittedly, the study is limited by a small number of participants who were disproportionately white women. Still, the study provides valuable insight into inclusive teaching development for faculty across different career stages. Future research could examine individual components of the framework presented in this study or design research that examines the interaction of variables, both quantitatively and qualitatively. Researchers could also focus on particular institutional contexts



and specific individual faculty characteristics (e.g., discipline, tenure status, race, gender) to better understand inclusive teaching and identify how best to support faculty who desire to become more inclusive instructors.

Conclusion

Despite increased attention to high engagement, inclusive teaching PD, little is known about the impact of such programming on inclusive instructor development. Through nine in-depth case studies, we examined how faculty members develop as inclusive instructors after participating in the Inclusive STEM Teaching Project (ISTP). Results demonstrate the key role that instructor identity plays in the development process. The study also illustrated the iterative and interlocking components of the heart (affective), mind (cognitive), confidence, and behavior, all of which are contextualized by individual and institutional levels of support and barriers. The study participants, regardless of their pre-existing teaching and DEI development, continued to develop as inclusive instructors, demonstrating that inclusive teaching is a dynamic journey and not a static destination. We recommend that faculty and faculty developers situate and balance programming within and across the dimensions of inclusive teaching development defined in this study to encourage holistic and iterative growth.

Data availability statement

The datasets presented in this article are not readily available because the potential for a breach of participant confidentiality.

However, the data can be made available by the corresponding author within reason as compliant with the data share policies and limitations of the funder of the study, the National Science Foundation (NSF). Requests to access the datasets should be directed to Lucas B. Hill, lhill6@wisc.edu.

Ethics statement

The studies involving humans were approved by The Human Research Protection Program (HRPP), University of Wisconsin-Madison. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

LH: Writing – original draft, Writing – review & editing. DB: Writing – original draft, Writing – review & editing. SW: Writing – original draft, Writing – review & editing. RF: Writing – original draft, Writing – review & editing.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. This material is based upon work supported by the National Science Foundation under Grants DUE 1821684; 1821571; 1821528; 1821510; 1821574. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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