



Facing the Challenge: Connecting Concepts to Practice to Improve STEM Faculty Professional Development

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Abstract

The National Science Foundation-funded Eddie Bernice Johnson INCLUDES Aspire Alliance (Aspire) has made efforts to address broadening participation in STEM through multiple initiatives, including faculty professional development. Aspire, recognizing the positive outcomes related to inclusive teaching, developed the Inclusive Professional Framework (IPF), a conceptual framework that was designed to address equity in STEM. The IPF is focused on foundational awareness, knowledge, and skill development that can be applied to all areas of faculty responsibilities, and in turn ensures that faculty are engaged in not only inclusive teaching, but inclusive practices across their multiple roles with students and colleagues. The IPF was created to center a reflective process, which in turn leads to self-reflexivity. The Aspire team found operationalizing the framework in concrete ways and building faculty skills in self-reflexivity to be more challenging than they had anticipated. Through qualitative interviews, this paper highlights the challenges inherent in moving from conceptual framework to practice by examining how developers and facilitators of the framework conceptualized the IPF and how they attempted to operationalize it in their personal or professional lives. This paper also underscores the nuancing that occurs as individuals continue to make sense of a framework after it is initially published and they begin to use it in their practice—field testing the ideas and concepts in the real world. This knowledge is especially helpful to faculty developers that work in centers for teaching and learning, higher education administrators, and faculty.

Keywords STEM · Faculty · Teaching · Professional Development · Inclusive Practices

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Introduction

There is a continued emphasis within science, technology, engineering and mathematics (STEM) higher education to improve the teaching and learning experiences of students to broaden participation, particularly amongst those who are historically underrepresented (National Science Foundation, n.d.). Social justice and inclusivity-focused teaching and learning frameworks are valuable for considering how to create more positive educational experiences (e.g., Marchesani & Adams, 1992). The National Science Foundation-funded Eddie Bernice Johnson INCLUDES Aspire Alliance (Aspire, n.d.) has worked to address broadening participation in STEM through multiple initiatives, including faculty professional development. Aspire, recognizing the need to increase inclusive faculty behaviors, developed the Inclusive Professional Framework (IPF; Gillian-Daniel, et al., 2021). The IPF is a conceptual framework focused on foundational awareness, knowledge and skill development across all faculty responsibilities, which ensures that faculty are not only engaged in inclusive teaching, but inclusive practices across their multiple roles with colleagues and students (e.g., collegueship and leadership, advising, and mentoring in research).

The IPF was created to center a reflective process that promotes self-reflexivity. According to Esposito et al. (2016), self-reflection is a “mental process through which self-knowledge is achieved” (pp. 36). Esposito et al. argue that self-reflection is the step before self-reflexivity, which is defined as the ability to understand how your own identity impacts your relationships with others and adapting your behaviors based on that knowledge. Currently, faculty professional development in STEM emphasizes the importance of student-focused pedagogical approaches like active learning (Haak et al., 2011), peer-led team learning (Snyder et al., 2016), and universal design for learning (UDL; Chen et al., 2018), among others. Although these efforts are important, there has not been a broad focus on self-reflexivity. The goal of the IPF has been to get STEM faculty to be self-reflective in their understanding, or lack thereof, of their own social and cultural identities and privileges, so that they can effectively navigate personal and cultural differences, and in turn, develop positive interpersonal relationships with students and colleagues. By promoting self-reflection towards self-reflexivity, the IPF presents a different approach to improving faculty pedagogy and practices.

Despite the IPF’s firm literature foundation (e.g., Salazar et al., 2010; Yosso, 2005; Bryson & Grunert Kowalske, 2022), the Aspire team found that operationalizing the framework and building faculty skills in self-reflexivity was more challenging than anticipated. Through qualitative interviews, this paper highlights the challenges inherent in moving from a conceptual framework to practice by examining how developers of the IPF and facilitators of IPF professional development conceptualized it, and then attempted to operationalize it in their personal and/or professional lives. This paper highlights the nuancing that occurs as individuals continue to make sense of a published framework and begin testing the ideas and concepts in the real world. A deeper exploration with developers and facilitators also illustrates how individuals’ identities contributed to the process of understanding the concepts of the framework as well as how they implemented it.

Understanding this process can provide insight into sense-making that occurs around other conceptual tools, particularly around pedagogical practices and the complexity associated with operationalizing such tools as they are evaluated and adapted to fit a variety of needs and contexts. We believe these insights can be especially helpful to faculty developers that work in centers for teaching and learning, higher education administrators, and faculty as they seek to bridge theoretical concepts to practice recognizing the challenges of doing so without adequate support.

Using Conceptual Frameworks

Conceptual frameworks are very effective at illustrating relationships and interactions between concepts. Conceptual frameworks can be particularly useful for identifying ways to improve teaching and learning to meet the needs of all students, particularly those who are historically underrepresented in higher education. For example, Marchesani and Adams (1992) presented a framework that focused on “multicultural” teaching and learning. Within their Dynamics of Multicultural Teaching and Learning model, they identified four critical domains that occur within teaching contexts: student, instructor, course content, and teaching methods. However, while the authors presented suggestions for who should consider adopting and implementing the model, they did not provide actionable recommendations.

Conceptual frameworks, like Marchesani and Adams (1992), can be valuable tools for practitioners, but without concrete understanding of how to put concepts into practice, it can be difficult to achieve the model’s intended outcomes. The translation of theoretical and conceptual constructs into practice continues to be a key issue within higher education (see Roth et al., 2014). According to Roth et al., this is not an isolated tension, and it exists within multiple practitioner oriented disciplines (e.g., nursing, non-profit management, and medicine).

The challenge of translating theory to practice occurs in STEM contexts as well. For instance, Beverly (2022) developed a conceptual framework that identified the effects of instruction on women in engineering classrooms. Although the framework identifies certain instructional methods that have an effect on women’s sense of belonging, self-efficacy, and desire to continue in engineering, it does not outline how this knowledge should be used in engineering classrooms. Often, researchers and practitioners tend to work in silos rather than together to enact meaningful STEM reform (see Henderson et al., 2011).

Further, conceptual frameworks can have ideas that are well understood, yet difficult to implement. For example, Connolly et al. (2007) studied how “teaching-as-research”, a new term devised by the Center for the Integration of Research, Teaching and Learning (CIRTL) Network, was conceptualized by program facilitators and participants at one network institution early in the project. They found that although study participants were able to clearly define the “teaching-as-research” concept, they had difficulty figuring out how to put it into practice. This was especially true of graduate students who had less teaching experience.

How individuals make meaning of the concepts they are learning has been discussed in the threshold concepts literature for faculty and faculty developers (Timmermans, 2014) as well as for faculty who are teaching students in their disciplines

(see Basgier et al., 2020; Hengesteg et al., 2021; Shopkow & Middendorf, 2019; Zito, 2019; Loertscher et al., 2014). A threshold concept is the way individuals make sense of a particular concept—the ‘Aha’ moment that individuals experience, which can be characterized as transformative. Threshold concepts are connected to the knowledge and skills one must acquire to engage in a particular activity. Similar to threshold concepts, the IPF provided participants with a scaffolded way to build awareness and learn the knowledge and skills necessary to engage in inclusive practices.

In early versions of the IPF, the Aspire team recognized the challenge of putting theory into practice both for themselves and their professional development participants. They sought to address this difficulty by using an iterative process to collectively refine that understanding. Yet, as illustrated below, the team continued for some time to struggle with linking the theoretical constructs of the model with practice. In this paper, we explore ways to make the process of putting theory into practice intentionally iterative in order to make conceptual frameworks, especially those focused on teaching and learning, more useful to faculty developers within centers for teaching and learning and higher education administrators. In addition, as faculty incorporate frameworks like backwards design (Wiggins & McTighe, 2005), flipped classroom (Akçayır, & Akçayır, 2018), and UDL into their teaching practices to support students’ learning of disciplinary knowledge, this paper may help them consider how they can create support structures for students who may struggle with the application of key disciplinary concepts.

The Inclusive Professional Framework (IPF)

The initial focus of the IPF was to help faculty become more inclusive in their teaching, mentoring in research, and advising, as a way to better support the experiences of marginalized STEM students. It was recognized through the process of iteration that the framework was a developmental conceptual framework; Aspire’s professional development programming took this into account by offering “level 1” and “level 2” IPF workshops. The team has continued to revisit and revise the framework wrestling with key concepts and how best to translate those concepts to a potentially broader audience. The framework has since been adapted and applied in other contexts, such as with STEM professional societies (Leibnitz et al., 2022) as a means to engage both individuals and higher education-aligned organizations in developing an equity mindset. The originating goal of the IPF has been to create organizational change that can better support diversity, equity and inclusion (DEI) initiatives within STEM classrooms, departments and institutions of higher education, as well as STEM organizations.

Figure 1 shows the three specific domains that represent the IPF: identity, intercultural, and relational. The identity domain (Dessel & Rogge, 2008; Ensher & Murphy, 1997; Museus & Ravello, 2010; Salazar et al., 2010) focuses on self-reflection to better understand how one’s social and cultural identities can impact others, and how aspects of one’s identity can shift depending on context. For example, for a faculty member, social and cultural identities do not change as they shift between the classroom and a departmental meeting. However the saliency of particular identities may change based on the positionality of who else is in the room. The identity domain

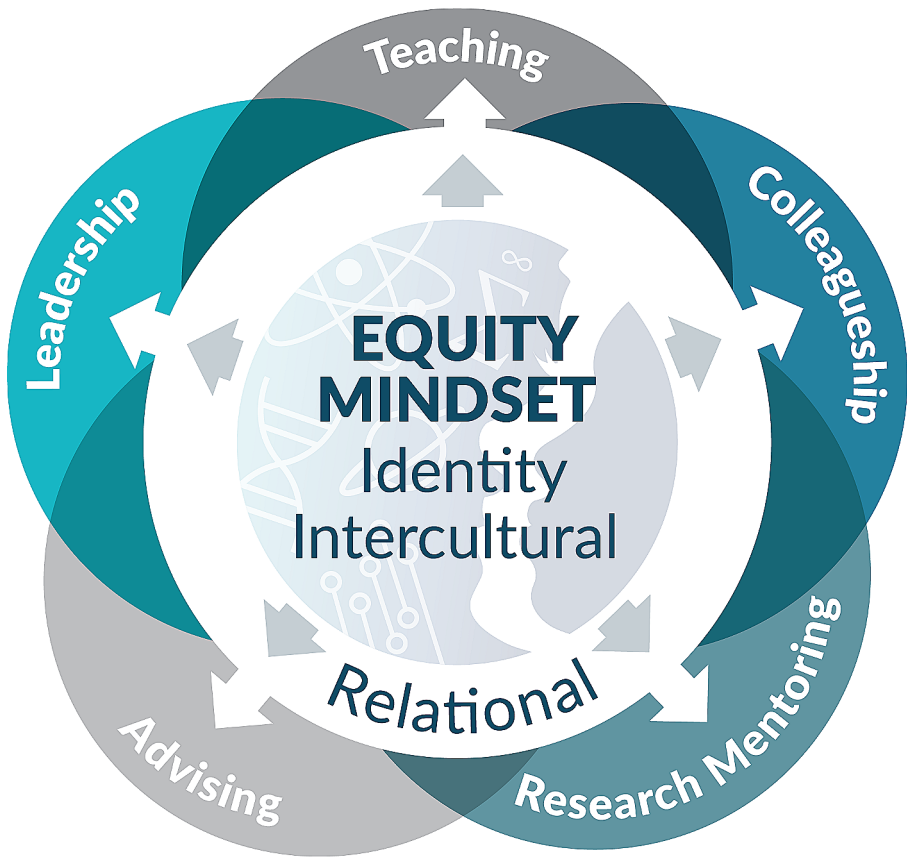


Fig. 1 Aspire's inclusive professional framework for faculty

is about helping faculty both develop a nuanced self-awareness, and learn how to support students with identities different from their own whom they encounter in teaching environments.

The intercultural piece of the framework (King & Baxter Magolda, 2005; Lee et al., 2012; Stanley, 2010; Yosso, 2005; Okun & Jones, 2000) focuses on developing one's own awareness about cultural differences and how to work with others from different backgrounds. It emphasizes the need to engage in "intercultural humility," a process of recognizing personal biases and privileges to better appreciate differences in backgrounds. It depicts how identities intersect to privilege some, and marginalize others.

The relational domain focuses on developing interpersonal relationships that involve trust and effective communication within an understanding of power dynamics (Alfred et al., 2005; Bryson & Grunert Kowalske, 2022; Ives & Rowley, 2005; Zurn-Birkhimer et al., 2011). These three different domains in the IPF work synergistically to help individuals, in particular faculty, develop an equity mindset that they can apply within their relationships with students and with colleagues. Self-reflexive praxis is key to the IPF—a way of trying to understand one's role in rela-

tion to others (Learning for Sustainability, n.d.). Engaging with and using the IPF in practice requires that individuals develop this understanding, drawing on similarities to Marchesani's and Adams' (1992) focus on instructor self-knowledge.

Aspire project members have written about the framework in various contexts (e.g., Leibnitz et al., 2022) and have incorporated it into in-person as well as synchronous online professional development programming, including a week-long summer institute (ASI). Participants in the ASI receive mentorship as they learn about the IPF, and have reported increases in their confidence to implement inclusive practices, gains in knowledge of key IPF concepts, and shifts in value of the IPF domains (Hill et al., 2023). For example, participants in the 2021 and 2022 institutes indicated that they gained knowledge about the intersectionality of social and cultural identities (identity domain), cultural differences (intercultural), and communication skills to build connection, trust, and relationship with others (relational).

The goal of this paper is to understand how individuals, through a self-reflexive process, conceptualize the domains of the IPF and combine that with knowledge gained in practice. The overarching question this paper addresses is: *How do those involved in contributing to the development of the IPF—both developers and facilitators—conceptualize the domains in the framework, and apply their understanding to their roles to advance DEI in STEM?*

Methods

Participant Recruitment

Once IRB approval was granted (UW-Madison IRB #: 2021-1234), those who had been involved in developing the framework (Developers), or facilitating professional development grounded in the IPF (Facilitators) were contacted through email to ask if they were willing to participate in a 30 min to 1 h interview. Upon agreement to participate in the study, participants were asked to fill out an electronic consent form via Qualtrics.

Interview Procedures

The initial interview protocol explored how the IPF was designed and how participants utilized concepts of the IPF to engage in STEM equity work. After using the protocol with the first six participants, it was determined that a shorter protocol that was more focused on how participant's backgrounds influenced their beliefs about DEI, their conceptualization of the IPF, and how they operationalized the framework was necessary. The updated protocol was used to interview the remaining nine participants. Both protocols were developed based on our research questions, while also considering literature on phenomenologically based interviewing that is effective in helping participants focus on experiences and make meaning from those experiences (Seidman, 2012). Semi-structured interviews were conducted with all participants ($n=15$) and were recorded on Zoom and transcribed verbatim. Interviews were conducted at a critical juncture, as the team was working to address the challenging task

of moving from framework to practice. All interviewees provided IPF-aligned professional development during the ASI, or in other settings (see Leibnitz et al., 2022). They were also involved in DEI work either as an institutional leader, faculty member, consultant, or administrator. Interview participants ranged in their usage and understanding of the framework. Some participants did not use the framework or used it very seldomly, while others were deeply engaged and invested in the framework and used it often. For detailed information on the participants please see Table 1.

Positionality

Before analyzing the data, the first author, who is of Latinx descent, considered her views of DEI particularly within STEM spaces. Her past research takes a feminist approach to understanding women's experiences with instruction in engineering classrooms. She utilized this research to recognize issues connected to power and identity within the data. This knowledge strengthened the analysis because she was able to recognize the systemic issues that can affect DEI in STEM.

Although the second author did not analyze the data, he engaged in conversations about interpretation of the data with the first author. The second author identifies as White and male, has been engaged in creating and delivering DEI-focused professional development for current and future faculty as well as institutional and organizational leaders for over 15 years, and was a developer of the IPF.

Table 1 Participant demographics

Pseudonym	Gender	Race/Ethnicity	Professional Position	Project Role
Willow	Woman	White	Faculty	Developer
Gertrude	Woman	White	Consultant	Developer
Rachel	Woman	White	Administrator	Developer
Raquel	Woman	White	Administrator	Developer
Derrick	Man	White	Administrator	Developer
Sandra	Woman	White	Administrator	Developer
Sam	Man	White	Administrator	Developer
Aurora	Woman	White	Administrator	Developer
Carlos	Man	Hispanic/Latino	Institutional Leader/Faculty	Facilitator
Cathy	Woman	White	Administrator	Facilitator
Emerald ¹	Woman	Black/African American	Faculty	Facilitator
Kara	Woman	Black/African American	Institutional Leader/Faculty	Facilitator
Leo	Man	Hispanic/Latino	Institutional Leader/Faculty	Facilitator
Sharon	Woman	White	Faculty	Facilitator
Lamar	Man	Black/African American	Institutional Leader/Faculty	Facilitator

¹ This participant was able to respond to questions connected to her background and its influence on her DEI beliefs but she was unable to describe the IPF domains and was therefore not included in the latter part of the study which focused on the conceptualization of the IPF.

Data Analysis

The first author developed a codebook before examining the data that used a priori codes based on the theoretical concepts informing the study. These codes included aspects of the individual's background and identities that influenced their DEI beliefs, their conceptualization of the IPF and its domains, the perceived synergy of the domains both conceptually and in practice, and how they operationalized the IPF. As the data was fully examined, open codes were added to the codebook based on new emergent themes from the interviews. NVivo software was utilized to code the data and to identify recurrent patterns and themes. To ensure validity and trustworthiness, the first author was aware of her subjectivity as an important part of the research (Peshkin, 1988). She engaged in analytic memoing throughout the process to capture ideas and any emerging interpretations and questions (Charmaz, 2014). This allowed for reflection on research questions and how data fit into themes or emerging patterns (Saldana, 2009). As she conducted the analytic memos she engaged in peer debriefing with the second author as well as colleagues that were a part of the leadership team for Aspire's National Change Initiative. This process allowed the first author to filter out any biases she may have had when conducting the analysis and to determine if her interpretations made sense.

Findings

Sense-Making of Identity and DEI

Derrick, Raquel, Sandra, Willow, Chris, and Leo ($n=6$) were not asked about their identity and its relationship to their desire to engage in DEI work. These participants discussed their commitment to diversity, equity, and inclusion, and their desire to create change through use of the framework. Upon an initial review of these interview transcripts, discussions of identities emerged and appeared to contribute to ideas of the IPF. Therefore, a new protocol was created to explore the relationship between identity and DEI work.

Participants from the second set of interviews ($n=9$) discussed how life events influenced their involvement in DEI work. This further contributed to their desire to disseminate the framework in meaningful ways. For example, Gertrude explained how her identity as a woman shifted as she aged and became a mother. Sexism she encountered throughout her career contributed to her wanting to participate in and contribute to DEI work. At the same time, she believed her privilege and race had come into focus as she engaged in the work,

My identity is...evolved, so initially what pulled me in most strongly was, well, being a feminist, I had a wanted equity with men. That was a young-person perspective. Then being a mother, I realized, whoa, by just becoming a mother, I had been marginalized in so many ways. It's fascinating, and my voice doesn't count as much. It's like my intelligence no longer exists and just 'cause I have a toddler that's screaming at my side. That influenced, again, my equity work. I think the more that one is stripped of privilege, as I age, as a woman in a cul-

ture, I've become much more sensitized to the experience of people who have been marginalized, which helps me want to leverage the privilege that I do have in service of greater voice.

Many participants ($n=5$) also discussed how experiences as children made them aware of race and discrimination, which caused them to be interested in DEI. Kara described moving from an all-Black school to a predominantly Italian school, where she was told that she was different. This, in turn, affected her and caused her to support marginalized individuals in her field rather than pointing out their differences. Having grown up in all Black schools including attending two HBCUs, Lamar grew to appreciate and value Black spaces. He credited his advancement in education to the positive experiences he had in all Black environments. Rachel and Sam also described how their experiences of being different led them to their beliefs about DEI. For example, Rachel described the discrimination she encountered as a result of having a disability, being a religious minority, and being a woman in the community in which she grew up. Sam described having an invisible disability and growing up poor in a community that was predominantly Black and White. He witnessed how differently Black students were treated and how they were given fewer opportunities than he was, which shaped his feelings about DEI,

I also noticed the people in our district, in our school who had money were almost always White and there were no rich Black kids. They were either middle class or upper middle class Black kids. ... I saw a lot of wasted talent...and the more I learned about racism and all these things, the more I realized that people may have given me the benefit of the doubt at times where they didn't give my Black friends a benefit of the doubt.

Sharon, a queer woman who was also first-generation, recognized systems of oppression through negative experiences in graduate school,

It's like you don't assume it's because you're a woman or because you're first generation, you just assume... You just are like, I'm not good at this, and I'm making it up until someone figures it out. You never thought, I'm experiencing this self-consciousness because this system was not set up for me.

Some participants ($n=3$) discussed how their experiences had shaped their views about DEI in STEM. For example, Kara felt strongly that underrepresented students had been “locked out” of STEM therefore preventing them from contributing to advancements in technology and science. Emerald also discussed similar sentiments, describing it as “cutting our own foot off because of this racialized hierarchy in STEM.” Lamar described how he supported and advised Black graduate students at PWIs to ensure their success. The identities that participants discussed had a large role in influencing their desire to engage in work centered on DEI, which in turn translated into an interest in the IPF as a tool to further equity-minded STEM reform.

Conceptualization of the Inclusive Professional Framework

Some study participants were involved in the development of the IPF ($n=8$), whereas others were involved in the dissemination of the framework ($n=7$) which involved incorporating it into professional development activities they led for Aspire. The differences in how developers and facilitators conceptualized the domains reveals the challenge inherent in operationalizing a conceptual framework. For example, development team members discussed theoretical concepts that contributed to the framework and how the process occurred, while facilitators grappled with the best ways to engage in the framework in a practitioner-oriented way. This is further elaborated when these different groups discussed their understanding of the domains.

Identity

The identity domain is defined using Crenshaw's (1991) concept of intersectionality which brings a deeper awareness of not only personal identities but of students' identities. This domain also examines the interplay identity has in contributing to the learning environment (Gillian-Daniel, et al., 2021). Identity was the one domain that was discussed similarly among developers and facilitators.

Both developers and facilitators ($n=14$) had similar perspectives on the identity domain. Both Rachel and Raquel felt that focusing on identity was very important to help others engage in more positive relationships. Rachel elaborated on the intentional part of including identity and of understanding yourself and others to ground the framework,

When you think about understanding and learning concepts around equity, that they're sort of a process. And that's where we began the steps like, what do you need to do first? Well, you need to understand identity and you have to understand your identity before you understand somebody else's identity. And once you understand your identity, even though that's a fluid thing, you can't unlearn that once you know that. And so that mastery becomes important before you can move on to whatever that sort of next piece is.

Similarly, Sharon, a facilitator, discussed how self-awareness and identity can contribute to improving relationships, particularly when faculty are in positions of power, explaining how identity awareness can help instructors be more inclusive,

I think before you can relate to anyone else, you have to understand your positionality, right? So, recognizing which spaces you hold power and the ways in which you hold power are the only way that you're going to understand how to leverage or execute differently.

Lamar explained how this domain helps people be aware of their identities and biases. Kara also explained how it is instrumental, particularly in STEM,

Identity development requires that you are in a context that promotes your growth, but if you're constantly facing resistance to it being marginalized or minimized in some way because you have this other frame of reference that you're trying to move forward on, it becomes really difficult to be an inclusive leader, inclusive teacher, or mentor when you don't have that supportive context.

Overall, facilitators and developers largely agreed that the identity domain was an extremely important part of the framework that was well-understood and not difficult to implement.

Intercultural

IPF developers appeared to have a clear conceptual idea of the purpose of the intercultural domain, whereas facilitators struggled with understanding the concept. According to Gillian-Daniel, et al., (2021), the Intercultural awareness domain, which also encompasses intercultural humility, is “an instructor’s ability to understand cultural differences in ways that enable them to interact effectively with others from different racial, ethnic, or social identity groups in both domestic and international contexts.”

Developers had a clear understanding of how this domain operated ($n=8$). Rachel described the intercultural domain as awareness of what contributes to interpersonal interactions, while considering others’ skills and perspectives. Aurora shared similar sentiments, “for intercultural, it’s not only important to just have awareness that others come from different experiences and have different viewpoints, but it’s also, again, not centering your experiences as the average.”

Gertrude explained the intercultural domain as intercultural awareness, “as a reminder to self to keep learning about other people and other cultures”.

Interestingly, some facilitators ($n=3$) struggled most with understanding and operationalizing this domain. Cathy explained that for her, she struggled with viewing the intercultural domain as separate from other domains and instead, viewed it as a bridge to the relational domain. Kara struggled with articulating how the intercultural piece operated within the framework. Lamar ($n=1$) appeared to have a clearer understanding of the domain, explaining it as “being respectful of those differences and how you can use those differences in positive ways such that people feel like they’re appreciated and they’re part of the process.” Therefore, although developers were able to clearly conceptualize the intercultural domain, some facilitators struggled with conceptualizing and operationalizing it, with the exception of Lamar.

Relational

Aspire describes the relational domain as “building one-on-one connection, trust, and relationship through effective communication and relational skills, which in turn support effective interpersonal interactions” (Gillian-Daniel, et al., 2021). This domain was well understood and similarly conceptualized amongst developers and facilitators.

Developers ($n=8$) like Aurora and Sam felt that the relational domain was connected to how you interact, speak, and work with others. Aurora believed that it was essential to consider the importance of developing meaningful relationships with students and felt it was important “that you actually make a connection and can put names to faces and remember things about the person so they feel like they are a person that you have established some kind of rapport with.”

Gertrude felt that the relational domain was the most important domain in the framework,

For me [it] is where the rubber hits the road. All the other things are sort of internal, but it’s how I communicate, how I relate with other people that manifests the deep work that I’ve done inside or not.

Facilitators like Lamar ($n=6$), similarly explained that this domain was connected to how you engage with others. Kara felt that the domains built upon one another leading to the relational part of the framework. Sharon felt that the relational domain was particularly important when power dynamics are involved and trust needs to be established,

I do think there’s relational dynamics that come up again between people who are in different positions of power and the ways in which we’re able to communicate with each other and express the things that we need or the things that we need in order to be successful, and potentially also express when we feel like there might be some kind of marginalization happening. That all depends upon the ability to build trust and feel safe in the space to communicate those things.

Both developers and facilitators had a clear understanding of the relational domain and were able to describe its connection to developing relationships. Many were able to understand how it was a product of the other two domains (identity and intercultural).

Synergy of the Domains

Both developers and facilitators ($n=14$) discussed how they viewed all of the domains working together to achieve the outcome of inclusive practices. Developers like Rachel explained how she viewed all the three domains working together, “I think they operate in a recursive way. They’re not linear. There are skills that are in each of these particular spaces that are important to personal professional development.”

Sam who was involved with an academic advising association shared how core competencies of advising were utilized when creating the IPF. For example, he described identity as the importance of knowing how to work with students from different identities, intercultural as how to work with students from different cultures, and viewed relational as building trust with students to work with them effectively.

Sandra, who was involved in initial stages of framework development, explained how she viewed the synergy of the three domains as people developing self-aware-

ness in the domains to figure out how to use them in developing skills. Aurora discussed the importance of how all the domains were linked together,

It's really hard to separate them out because you need to have a fair understanding of identity to be able to make those connections with people. And then you need the relational skill to also make those connections to people.

Facilitators like Sharon, who utilized the framework in her instructional practice, understood the domains based on her experiences as a faculty member. She discussed the importance of understanding her own identity, being aware of intercultural perspectives, and building trust with students. Facilitators also appeared to recognize areas that they felt were missing from the framework when discussing how the domains operated together. For example, Kara and Cathy discussed how context and guidance of how to operationalize the framework were missing. Kara explained how the discussion of STEM culture was missing, particularly discussions about how STEM assumes neutrality and objectivity. Cathy also pointed out that a discussion of STEM culture was not evident within the framework. She explained that although the framework had an intercultural domain, “the framework itself doesn’t acknowledge the culture in which those relationships occur.”

Although developers and facilitators viewed the domains working together in similar ways, facilitators appeared to hone in on what was missing from the framework potentially due to the fact that they were putting the domains into practice.

Beliefs about the Impact of the IPF

Participants ($n=14$) recognized the value of the framework, particularly its utility in helping people understand their positionality and the need to have self-awareness in order to have individuals develop an equity mindset. Rachel explained why the IPF was different than other STEM professional development, “I think that is different [from] where we see a lot of the training in STEM, which is often symptomatic or reactionary. And this is more about developing the individual to be able to perform better in multiple spaces.”

Both Derrick and Sam felt that the tool overall was a way to help support under-represented students in STEM. Sam described the importance of the framework in helping students from different backgrounds,

The IPF gives all of us those sets of tools because again, people are coming to college from all sorts of walks of life. And...if you don't know how to work with a student because of their background or whatever, then you're not giving them a fair chance.

Carlos and Lamar found value in the reflective aspects of the framework and the social justice lens. Carlos explained how much he valued the introspection the framework required,

The emphasis on starting with self-exploration, really rigorous analysis of who am I in this world, and how do I shape it, and how does society and the social system in which I live contribute to that shaping, and what can I do? So, really helping people develop that positionality and intersectionality of awareness.

Lamar also believed that the framework had value because he viewed it as a “cousin” to Critical Race Theory (CRT) which he felt made it more “palatable” to others,

One of the things I like most about [the IPF] is how it really interrogates systems and it allows you to interrogate them without coming across like you’re an interrogator. Because that can turn people off, as you probably know. So, for me, I like it’s soft approach in many ways.

Participants found value in the way the framework emphasized positionality and identity awareness which they found were the most impactful parts of the framework.

Translating Theory to Practice

Developers used the IPF as the foundation of professional development that they provided as part of Aspire. They used formative and summative evaluation results from professional development sessions to iterate how they engaged participants with the framework and addressed challenges of framework operationalization. Feedback supported the refinement of activities and the development of new activities. For example, IPF workshops for faculty initially used a reflective activity leveraging Tara Yosso’s (2005) Community Cultural Wealth model to help participants take an asset-based approach toward students. Formative feedback and new audiences (e.g., department chairs) led to the development of a reflective activity about professionalism standards grounded in Okun and Jones’ (2000) work about White supremacy culture in higher education. The shift used workplace cultural norms as an entry for discussion about the intercultural domain of the framework because it was more accessible to audiences that were often majority White.

In addition, developers worked with facilitators annually to integrate the IPF into topic-driven sessions that they led at the ASI. Iterative conversations supported ongoing refinement of how the framework was integrated into these presentations, and each subsequent year allowed for more nuanced inclusion. Over several years, the developers also added team action planning to the ASI and progressively integrated the IPF into the associated activities. This allowed institute participants to consider during the action planning process how social and cultural identities and intercultural differences impacted teamwork and dynamics. It also encouraged them to consider concepts like design justice (Costanza-Chock, 2018). These iterative changes by developers, while not initially planned, became an essential part of providing a solid foundation for both workshop and ASI participants to help them consider how to use the IPF in their practice.

Although steps like team action planning were taken to address the practical application of the framework, challenges continue in identifying ways to assist people in applying the framework to practice. Many participants in this study described want-

ing tangible steps to use to help others implement the framework. Lamar felt that there should be a “CliffsNotes” version of the framework that covered the areas but did not go so much in depth that it turned people off, while Willow felt the IPF should be “practical”, “accessible, and usable.” Like Willow, Leo felt that having resources that provided clear ideas on how to implement the framework would be useful. Sharon described it as needing “tangible, actionable outcomes.”

Some developers also recognized the struggle associated with taking the theoretical framework and operationalizing it. Rachel indicated that she felt it was “stuck in a way where people come, they learn about it, and then they kind of go away.” She felt it would be useful to demonstrate to others the ways you can use the framework. Gertrude described the framework needing the addition of “influential actions” as a fourth domain. Although most participants explained wanting more direction for operationalizing the framework, Raquel argued that the original team did not feel providing a list of actionable items would be helpful to participants. She felt it was important that individuals think deeply about how the framework could apply to their specific institutions or contexts, while at the same time recognizing the importance of providing guidance on how to operationalize the IPF.

Implementation of the IPF

Developers and facilitators ($n=9$), described how the IPF informed their work and discussed ways they were incorporating the framework into their positions. Both Kara and Leo took ideas from the IPF and implemented programs within their own colleges/universities. Kara, who is a Dean of a STEM college, created a department grant to improve curriculum around DEI, whereas Leo, an Associate Dean of a STEM college in a university, developed a website with resources for faculty and staff to use to incorporate DEI practices into their teaching. Sharon, an instructor, indicated that she wanted to integrate the IPF into training other faculty/instructors in her department to help them learn about inclusive pedagogy, while Aurora utilized the IPF to center equity in the faculty professional development she led. Sandra, a program manager, was in the process of developing an IPF toolkit for departments to utilize. Both Sam and Willow, who were associated with a national advising organization, shared how they were using the IPF to discuss advising with faculty. Gertrude also indicated that she was thinking about how she could apply the IPF to address conflict, particularly within broader STEM professional communities.

Discussion

Study participants were deeply influenced by personal, identity-related experiences, which resulted in specific beliefs about DEI. Many discussed experiences with “difference” when they were growing up due to personal demographics (e.g., race, culture, gender, socioeconomic status, and disability). These experiences contributed to their ideas about equity, which in turn contributed to their interest in developing or facilitating professional development utilizing the IPF.

The identities and personal experiences developers and facilitators brought to the project influenced the way they conceptualized the different IPF domains. All of the participants had a clear understanding of the importance of the identity and relational domains of the framework. Amongst the facilitators there was a less clear understanding of the intercultural domain. Overall, most were able to articulate the intercultural domain as involving interaction with others from different backgrounds. In addition, each participant had their own way of describing how the different parts of the framework worked together, sometimes connecting it to their own positions. For example, Sam, who had a history of working in academic advising, took a student perspective with the framework, while Sharon, who was an instructor, viewed the framework from a faculty perspective. Overall, participants described the domains as needing to work together to promote an equity mindset. They pointed out that alone, the domains would not achieve the intended outcomes.

Aspire developed the IPF to support faculty developing more equitable and inclusive practices across their roles. All of the study participants discussed how they valued the framework, and discussed how it is different from other professional development approaches because of the focus on deep introspection. They also saw value in the framework's potential to advance equity in STEM. Because such attention was given to the process of introspection, we argue that this framework can be used as an effective tool to support faculty, particularly in STEM, who may be hesitant about engaging in inclusive practices.

Nearly all of the participants discussed how they utilized aspects of the IPF in their personal lives, and how it had positively influenced their interactions with others. Nine participants were using the IPF in their work. Kara, for example, had developed grants for faculty in her STEM college to adapt curriculum to be more equity-centered, while Leo had developed a central online DEI resource repository. Individuals in positions where they interacted with faculty appeared to be more inclined to integrate the IPF into their work. At the same time, both developers and facilitators ($n=10$), indicated that although they found value in the framework, they continued to struggle with how to operationalize the framework and wanted more tangible directions for doing so.

The IPF has had success being adapted for other areas such as for STEM societies (Leibnitz et al., 2022) and is currently being adapted for advising as well as organizational culture and collaborative dynamics. We feel that this would not have been possible without continued discussions around the concepts of the framework and the bridge built between theory and practice. As DEI has become a complex issue more recently, the IPF presents an opportunity to continue the much needed work of not only attracting, but retaining those who are historically underrepresented in STEM. The strength of a framework like the IPF is due to consistent feedback from developers, facilitators, and participants, and ongoing nuancing of the framework to determine better ways to engage STEM faculty.

The IPF provided participants with a scaffolded way to learn the knowledge and skills necessary to engage in inclusive practices. The developmental nature of the IPF—the understanding that its use and adoption is an iterative process—supports instructors' learning. Because the IPF was created to center a reflective process that promotes self-reflexivity, and the work of self-awareness and exploration is iterative,

and different for each individual, we believe that the IPF provides concepts that are foundational to faculty taking an equity-centered approach to their teaching. And while threshold concepts are useful in providing an understanding of how individuals make meaning of certain ideas, one's understanding of threshold concepts can evolve with experience (Timmermans, 2014), and there still can be struggles with the implementation of such concepts. Also, one's understanding of a concept, no matter how sound, does not always translate into practice. Our study reveals how individuals who understood many of the concepts of the IPF quite well still required guidance and further exercises to move them toward practical action. This knowledge is especially helpful to faculty developers that work in centers for teaching and learning, higher education administrators, and faculty. These various roles all require some form of teaching—that the “instructor” supports the “learner” in not only grasping key concepts but being able to apply those concepts in their work or disciplines.

We argue that conceptual frameworks or models that are focused on changes to instructional practices in higher education must consider the best ways to sustainably engage instructors. Instructors are often overburdened and worry that pedagogical changes will take too much class time or require too much effort (Bathgate et al., 2019). Getting instructors to apply concepts to practice in a supportive and structured environment, utilizing frameworks for learning like the IPF, and doing so in a planned and iterative way, may give them the impetus to engage more deeply with such concepts. As it was challenging for many of the participants in this study to find ways to implement the framework in different ways other than teaching, for an instructor it may be especially daunting.

Implications

As STEM DEI-focused faculty professional development continues to be a valuable tool to increase engagement and retention of marginalized student populations, it is even more important to consider how to effectively translate DEI-focused, teaching and learning-centered, conceptual frameworks into practice. This study suggests that when thinking about concepts and theoretical frameworks, translating the concepts to practice is the most important step. This process needs to support users' sense-making, as well as ongoing model iteration and refinement. While Aspire developers originally chose not to provide a list of actionable items in order to promote deep personal reflection, both developers and facilitators recognized that more guidance was needed.

This guidance could take multiple forms. First, we suggest that developers provide more tangible ways for users to implement a framework across different contexts, which in our case meant classroom, department, institution, as well as disciplinary society or organization. Next, developers need to consider how practitioners can be overwhelmed with responsibilities, and in turn feel time-limited. These limitations could be addressed through development of case studies or case books, which more directly link theory to practice through concrete examples. Then, developing assessment tools or inventories that identify an individual's or organization's current status, as well as potential next steps for framework implementation, would be valuable. Faculty developers should also consider providing a bridge for instructors between

the conceptual and the practical when pedagogical frameworks are introduced either through hands-on activities, such as action plans that were enacted for the IPF, or by providing a list of tangible actions, as suggested by one of the IPF facilitators.

Overall, putting theory to practice in educational contexts continues to be a challenge. Therefore, including practitioners in framework conceptual development is essential to its ultimate adaptation to practice. Intentionally piloting a framework with practitioners to garner formative and summative feedback, and then adapting the model in an ongoing way to better suit their needs, will help ensure that they clearly understand its applicability.

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Declarations

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