Work in Progress: Developing and Measuring the Adoption of Identity-Inclusive Computing Tenets

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INTRODUCTION

This work-in-progress paper presents the development and piloting of an instrument to assess the adoption of and barriers to implementing the Identity-Inclusive Computing (IIC) Tenets developed by the Alliance for Identity-Inclusive Computing Education (AiiCE) [1]. IIC examines how identity (e.g., race, ethnicity, gender, sexuality, ability, socioeconomic status) impacts and is impacted by computing [2]. Broadening participation in computing (BPC) necessitates addressing systemic inequities within academic and professional computing cultures that disadvantage people with marginalized identities [3]. While numerous student-centered interventions exist [4]-[13], sustainable progress requires holistic, complementary approaches targeting the people, policies, and practices that impact them [14]-[16].

Recent frameworks like Culturally Responsive-Sustaining Computer Science (CRCS) [17]; Universal Design of Computing Departments [18]; and Capacity for, Access to, Participation in, and Experience of Equitable CS Education (CAPE) [19] provide guidance on creating more equitable policies, environments, and curricula. The IIC Tenets aim to build on these efforts [1].

Results from this study will inform future revisions of the IIC Tenets and establish a baseline for longitudinally assessing AiiCE's impact. Additionally, this research contributes to the expanding work on computing-specific frameworks for creating identity-inclusive learning environments, which is increasingly important, given efforts to restrict diversity, equity, inclusion, and accessibility (DEIA) initiatives in education. The remainder of this paper is organized as follows. First, the instrument development, data collection, and analysis methods are described. Then, the results section details respondent characteristics, tenet use, and identified barriers. We conclude with a discussion, limitations, and future work.

POSITIONALITY STATEMENT

We are a diverse team of scholars who all hold at least one identity that is historically underrepresented in computing and STEM (women). Our varied racial identities (white and Black), geographical locations (all within the U.S.), ages, disciplines (physics and computing), and disability statuses situated our contributions to this work and provided a broad analysis of the current state and possible future directions.

METHODS

Instrument Development

The instrument was developed in the summer of 2023 as a 17-item survey and included items related to demographics (race/ethnicity, gender, disability status, professional role, geographical location, school or organization type and designation, department, and participation in AiiCE activities); core areas [Professional Development, Curricula & Pedagogy, and Policy (K-12 or Postsecondary, based on professional role)], with corresponding tenets as sub-items; barriers (if present) or other reasons impacting tenet use; and additional information or feedback from respondents. The anonymous survey was administered via Qualtrics, and results were exported to CSV and Microsoft's Statistical Package for the Social Sciences (SPSS) files for analysis.

Table 1 lists the IIC Tenets, categorized into three areas: Policy (K-12 and Postsecondary), Curricula & Pedagogy, and Professional Development.

Table 1. Identity-Inclusive Computing Tenets

Policy (K-12)	**Curricula & Pedagogy**
KP.1 Definition and prioritization of CS as a "core subject."	CP.1 Inclusive and equitable CS classroom cultures that are co-created to ensure meaningful learning experiences and a sense of belonging for all students.
KP.2 Adoption of and provision to schools with curriculum and instructional materials that are aligned with identity-inclusive topics and approaches.	CP.2 Pedagogy and curriculum that are aligned to appropriate standards and authentic to students' experiences, interests, and cultures.
KP.3 Assurance during procurement process that hardware & software are accessible.	CP.3 Student voice, agency, self-determination, and advocacy are valued, encouraged, and incorporated throughout the learning process.
KP.4 Removal of institutional and access barriers to CS courses and exams.	CP.4 Families and communities (including their cultures and assets) are incorporated into the design of learning opportunities.
KP.5 Provision of comprehensive educator preparation and professional development programs that support identity-inclusive pedagogy and practices.	CP.5 A range of experts who are incorporated into learning opportunities (including researchers and community members).
KP.6 Development of local, regional, and state CS education plans that center identity-inclusive computing practices.	CP.6 Curricula that address the social legacy of the uneven impacts of CS.
KP.7 Development of incentive structures to recruit, prepare, and retain a diverse pool of CS teachers.	**Professional Development**
(Postsecondary)	PD.1 Definitions of identity (e.g., race, ethnicity, gender, class, sexuality, and disability), intersectionality, oppression, power, and other relevant concepts.
PP.1 Create or improve pathways to discovering, entering, participating in, and completing computing majors.	PD.2 Examination of disparities related to identity (racism, sexism, xenophobia, classism, ableism, homophobia, transphobia, and more) and how they're reflected in CS education and the tech industry.
PP.2 Institutionalize identity-inclusive computing across multiple courses within department curricula.	PD.3 Reflection on the current state of identity-inclusive computing in schools, departments, and other institutions.
PP.3 Expand the definition and balance of scholarly work that is valued in computing departments.	PD.4 Support for the development of pedagogy and/or practices that lead to anti-oppressive and identity-inclusive spaces.
PP.4 Recognize and address the oppressive nature (e.g., ableism, elitism, misogyny, and racism) of the hiring, promotion, and tenure processes.	PD.5 Guidance to develop or adapt identity-inclusive curricula and assessments.
PP.5 Provide comprehensive, IIC-informed professional development for faculty, staff, and teaching assistants (TAs).	PD.6 Strategies to empower individuals to enact change.
PP.6 Regularly solicit and incorporate feedback on department climate from students, faculty, and staff of diverse identities.	
PP.7 Identify, implement, and promote a student-centered grievance process that addresses the inequities inherent in existing power structures.	

Data Collection and Analysis

Following IRB approval, data collection occurred during the fall 2023 semester. The target population was K-16 computing educators, administrators, policymakers, and advocates. Participants were solicited via recruitment emails to people completing AiiCE professional development activities [i.e., K-12 Teacher Policy Committee, Chapter Liaisons, Teacher Inquiry Groups, CS Equity Coaches, Identity-Inclusive Instructors Summit, AiiCE Teaching Assistant Professional Development, and Cultural Competence in Computing (3C) Fellows]. Recruitment emails were sent to the INCLUDES National Network as well as the SIGCSE, Black in Computing, and American Society for Engineering Education (ASEE) division listservs [Engineering and Public Policy Division (EPPD); Engineering Ethics Division; Equity, Culture, and Social Justice in Education (ECSJ); Liberal Education/Engineering and Society Division (LEES); Minorities in Engineering Division (MIND); and Women in Engineering Division

(WIED)]. Participants received information detailing the purpose, informed consent form, and survey link. A total of 212 participants completed the survey. Fifty-eight incomplete responses (i.e., completed less than 75%) were removed, and the remaining 154 responses were analyzed.

Closed-ended data were processed using SPSS, and open-ended responses were coded in Excel. Quantitative analysis included obtaining frequencies and the disaggregation of data based on respondent demographic information. Open-ended responses were reviewed, analyzed with emergent codes to identify themes, and discussed among the research team.

RESULTS

Of the 154 respondents, 48% were white, 16% Black or from the African Diaspora, 15% Asian, 12% two or more races, 3% Middle Eastern or Northern African, 1% Latinx/Hispanic, 1% identity not listed (including one respondent identifying as Ashkenazic Jewish), and 4% undisclosed. Approximately 50% of all respondents were women, 39% men, 5% non-binary, 1% self-identified, and 5% undisclosed. Approximately 16% of respondents had a disability or chronic condition, 74% had none, and 10% undisclosed. Geographically, 95% of respondents resided in the United States (representing 34 states, D.C., and the U.S. Virgin Islands), with most residing in North Carolina (20%), Massachusetts (12%), and Georgia (9%). Approximately 5% were from Afghanistan, Brazil, Cyprus, Hong Kong, Italy, Nigeria, and Sweden.

Professionally, 57% and 20% of respondents were postsecondary faculty and administrators/other roles, while 14% and 12% were K-12 educators and administrators/other roles. Finally, 59% of all respondents participated in at least one AiiCE-related activity (e.g., one-time webinars and sustained programs), with 3C Fellows being the most common (44%).

Tenet Use

Fig. 1 shows the frequency (None Used, 1-2 Used, and 3+ Used) of tenet use for all respondents (N=154). Most respondents reported using 3 or more tenets across all areas. Additionally, Curricula & Pedagogy contained the most used tenet with 65% of all respondents using CP.3. The least frequently used tenets were CP.4 and PP.2 (each used by only 25% of respondents).

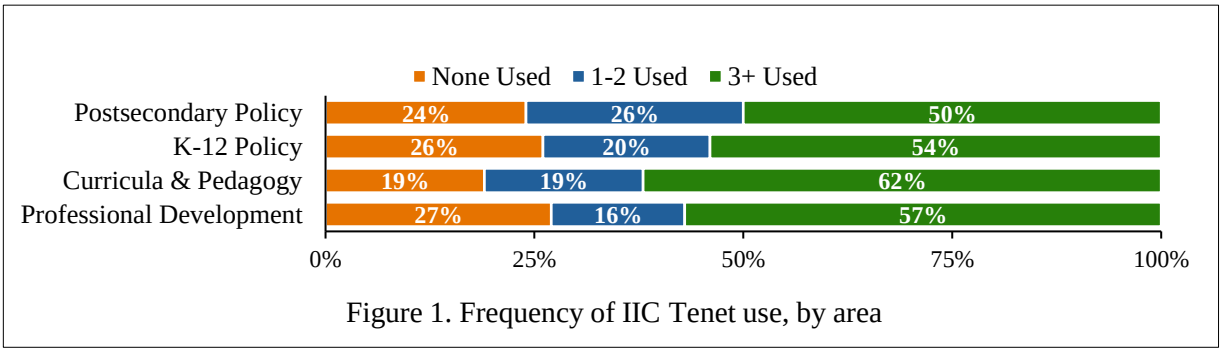

Figure 1. Frequency of IIC Tenet use, by area

Black respondents were most likely to report high use (using 3 or more tenets) across all areas, with 79% (Professional Development and Curricula & Pedagogy) and 71% (K-12 and Postsecondary Policy). All Latinx respondents (n = 2) reported high use of Professional Development and Postsecondary Policy tenets. White and multiracial respondents also indicated high use of Curricula & Pedagogy (70% and 68%) and 68% of multiracial respondents indicated high use of Professional Development. Women and non-binary respondents reported high use of Professional Development (60% and 88%, respectively) and Curricula & Pedagogy (66% and 75%) tenets. Black, Asian, Latinx, and multiracial women reported high use of Professional

Development more frequently than white women [80%, 57%, 100% (n = 1), and 75% compared to 54%]. Black and multiracial women reported high use of Curricula & Pedagogy more frequently than white women (80% and 75% compared to 71%). Similar trends were seen for Policy, with Black, Latinx, and multiracial women using three or more Postsecondary tenets and Black and multiracial women using K-12 tenets more frequently than white women. Across all disability statuses, more than 50% of respondents reported high use of Professional Development, Curricula & Pedagogy, and Postsecondary Policy.

Respondents reported high use of the Professional Development and Curricula & Pedagogy tenets more frequently if they resided in the U.S. Northeast, Postsecondary Policy if in the U.S. Southwest, and K-12 Policy if in the U.S. Southeast or non-U.S. locations. K-12 respondents reported high use for Professional Development (71%, compared to 53% in postsecondary roles) and Curricula & Pedagogy (74%, compared to 59%). In addition, those who engaged with AiiCE were more likely to report high use in all areas, compared to those who had not.

Barriers and Other Reasons Limiting IIC Tenet Use

Table 2 presents the barriers to implementation that may be or are present (31%, and 33%, respectively), as well as other reasons (36%). Additional barriers, provided via text-entry responses, included a lack of funding or time; pushback from supervisors, organizations, or institutions; lack of support; and activities not "counting" for promotion and tenure packages. Other reasons, provided via open-ended responses, included difficulty integrating IIC concepts into curricula, time constraints, and perceived irrelevance to respondents' work.

Table 2. Barriers and Other Reasons Limiting IIC Tenet Use

	Percent of Respondents
Barriers (n = 93)	
State, local, or organizational policies	37%
Unsure of how to incorporate them into current courses or department	30%
Concerned about possible retaliation	29%
Do not feel knowledgeable enough about the topics to incorporate them	28%
Other (text-entry response)	36%
Other Reasons (i.e., no barriers reported; n = 53)	
Unaware of the full set of IIC Tenets until now	47%
Have already incorporated many of the IIC Tenets	32%
Not interested in incorporating the IIC Tenets	2%
Other (text-entry response)	19%

Respondents who indicated barriers were present most frequently noted policies (37%), and those who indicated other reasons most frequently reported a lack of awareness (47%). Additionally, non-white respondents reported each barrier the most. For example, 64% of Black and all Latinx (n = 1) respondents reported policies, Middle Eastern or Northern African respondents (n = 3) reported incorporation uncertainty and knowledge gaps (67% and 100%, respectively), and 36% of Asian and all Latinx respondents reported retaliation concerns.

Women most often reported policies as a barrier (42%), with multiracial and Black women reporting even higher rates (80% and 62%, respectively). Respondents with and without disabilities cited barriers equally, except for lack of knowledge (12% and 34%, respectively). Women with disabilities reported fear of retaliation and other barriers the most (42% and 50%, respectively). We note that no Black, Asian, and Latinx women or non-white respondents with disabilities reported a lack of knowledge. Additionally, non-white women with disabilities most often reported policies (75%). Geographically, respondents in states with anti-DEI laws were

more likely to report incorporation uncertainty and knowledge gaps (47%) than policies (35%), with respondents in states with anti-DEI legislation introduced (but not signed into law) most often reporting policy barriers (50%). Respondents reporting other reasons limiting usage most often cited a lack of awareness. Additionally, respondents who never participated in AiiCE activities were more likely to be unaware of the IIC Tenets.

DISCUSSION

Respondents from racial and gender groups that are historically underrepresented in computing were more likely to use 3 or more tenets across all areas. Additionally, reported barriers varied depending on race/ethnicity, gender, and disability status. The high use of IIC Tenets, coupled with minimal lack of knowledge of barriers reported by all non-white respondents (excluding Middle Eastern or Northern African respondents and including those with disabilities), indicates that respondents who are historically underrepresented in computing are very aware of their positionality, which is likely due to navigating oppressive academic, professional, and general spaces. Additionally, the high use of IIC Tenets by K-12 respondents suggests: 1) there are more standardized mechanisms for incorporating equity and inclusion into K-12 professional development, curricula, and policy; and 2) there is a need for more support at the postsecondary level. Respondents participating in at least one AiiCE activity were more likely to be high users of the framework, suggesting that AiiCE engagement results in participants more frequently integrating the tenets. Finally, the overall percentage of respondents reporting uncertainty, lack of knowledge, and unawareness of the IIC Tenets underscores the need for further dissemination and discussion of this framework within the broader computing and STEM communities.

LIMITATIONS AND FUTURE WORK

Results from the preliminary version of this instrument identified limitations to address in the next iteration. For example, a respondent noted that the race/ethnicity question lacked a text entry for the “my identity is not listed” response option. Additionally, items related to tenet use should include a response option to indicate that no tenets within a specific area are utilized. Items for each tenet should also include a Likert scale to better measure frequency of use. Additional barriers were identified in open-ended responses that will be added to the response options. Further work includes revisions to the survey and annual data collection to provide community members with an important snapshot of progress being made and areas of growth.

CONCLUSION

This work-in-progress paper presents the design and preliminary findings of an instrument that examines IIC Tenets and barriers. As the community continues to address DEIA challenges, it is crucial to adopt an IIC approach and understand how the framework is used in the larger community. Current local, state, and national efforts to eliminate DEI in K-16 education make the instrument an important tool for understanding the barriers faced by the BPC community. Finally, the IIC Tenets are situated within computing education; however, the interdisciplinarity of computing demands these tenets (as well as discipline-specific, identity-inclusive approaches) are utilized across STEM. Thus, this work serves as a blueprint for other STEM communities to develop, disseminate, and measure the use of discipline-specific frameworks.

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