When Twice as Good Isn't Enough

The Case for Cultural Competence in Computing

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ABSTRACT

The commonly documented diversity, equity, and inclusion (DEI) issues in the computing workforce are the direct result of corporate cultures that benefit specific groups and marginalize others. This culture usually begins in undergraduate computing departments, where the demographic representation mirrors that of industry. With no formal courses that focus on the non-technical issues affecting marginalized groups and how to address and eradicate them, students are indirectly taught that the current status quo in computing departments and industry is not only acceptable, but also unproblematic. This directly affects students from marginalized groups (as the reasons for attrition are similar in both higher education and industry), as well as faculty (as biased student evaluations directly affect hiring, promotion, and tenure decisions).

This position paper presents the need for cultural competence as a required focus for university computing departments nationwide. By improving these issues before students complete baccalaureate computing degrees, companies will have talent pools that better understand the importance and necessity of DEI and also work to ensure they help foster a more diverse, equitable, and inclusive environment. In addition, more students from marginalized groups will be retained in the major through degree completion.

CCS CONCEPTS

• Social and professional topics~Computing education programs • Social and professional topics~Race and ethnicity • Social and professional topics~Gender • Social and professional topics~Cultural characteristics

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KEYWORDS

Cultural competence; computing; diversity; inclusion; race; gender

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1 Introduction

As the tech industry continues to struggle with creating and sustaining diverse, equitable, and inclusive work environments for current and prospective employees [27], [41], the experiences of marginalized groups in industry mirror their experiences in university computing departments nationwide [17], [27], [43], [57]. While most university computing departments offer courses on computing ethics [1], [16], the overwhelming majority of these courses focus primarily on the societal and legal impacts of topics such as the Internet, privacy, intellectual property, and cybercrime. To the best of the author's knowledge, only one focused on the biases in academic and work environments that directly impact not only who pursues computing degrees and careers, but also the technologies they create.

The commonly documented diversity, equity, and inclusion (DEI) issues in the computing workforce are the direct result of a lack of required cultural competence in university computing curricula. Without direct and intentional inclusion of this topic (including meaningful and impactful discussions of race, gender, intersectionality, bias, discrimination, and their impact on people and technology), then the majority White and Asian male-dominated classes of new computing graduates enter organizations where the established corporate cultures favor their beliefs, practices, and identities. This continues to create the current problem, where DEI efforts are discussed as needed, but not properly or adequately addressed to have significant impact. This position paper presents the need for cultural competence as a required focus of university computing departments nationwide.

The logic that industry will be able to properly address the DEI problem is false, as any preconceived notions about computing (more importantly who and what a computer

scientist looks like) have been reinforced for years through K-12 and postsecondary education. While numerous efforts focus on ensuring that the computing landscape better reflects the actual U.S. population (including every K-12 student having access to computer science courses before high-school graduation) [3], [23], [30], [52], there is still much work to do at the postsecondary level, where the DEI issues are just as prevalent and include not only students from marginalized groups, but also faculty [20], [26], [28], [33], [44], [56].

The remainder of this paper is organized as follows. Section 2 discusses the elements of cultural competence, as described from relevant literature. Section 3 discusses the measurable stages of cultural competence. Section 4 presents the rationale for cultural competence in computing. Section 5 presents a proposed implementation of a cultural competence in computing program, including the assessment and course. Section 6 concludes the paper.

2 Elements of Cultural Competence

The concept of cultural competence first emerged in social work and counseling psychology as ethnic competence [19], [24] and cross-cultural counseling [38], [45], respectively.

Its more common name (cultural competence) and definition were derived in [12] as

> "(A) set of congruent behaviors, attitudes, and policies that come together in a system, agency, or among professionals and enable that system, agency, or those professionals to work effectively in cross-cultural situations. The word 'culture' is used because it implies the integrated pattern of human behavior that includes thoughts, communications, actions, customs, beliefs, values, and institutions of a racial, ethnic, religious, or social group. The word competence is used because it implies having the capacity to function effectively."

While there are debates surrounding the classification of cultural competence as a theory, framework, or perspective [20], its need (along with intentional and continuous training to develop it) has been well documented in fields such as social work, healthcare, and education [2], [6], [7], [13], [31], [55]. Note that, for consistency with Cross et al., the term "culture" is used throughout this paper to encompass various constructs (i.e., race, ethnicity, gender, sexual orientation, religious affiliation).

Cross et al. define five essential elements for a culturally competent system, agency, or institution, as noted in Table 1. Recent literature defines four major components of cultural competence: awareness, attitude, knowledge, and skills [47], [54]. Table 1 aligns these four components to the work of [12] for consistency. Each element (and corresponding component) are discussed below.

Table 1. Elements of cultural competence comparison.

Cross et al.	Recent Literature
Valuing diversity	Attitude
Cultural self-assessment	Awareness
Consciousness of the dynamics of difference	Skills
Institutionalized cultural knowledge	Knowledge
Adaptations to diversity	Skills

2.1 Valuing Diversity (Attitude)

Valuing diversity means people understand, appreciate, and respect its worth [12]. It is important to note that, first, diversity is relative to the factor(s) being considered (e.g., race, ethnicity, gender, sexual orientation, religion, age, and ability). Second, a diverse environment can still lack inclusion, especially when individuals in key positions refuse to address systemic issues such as micro- and macroaggressions, bias, and discrimination (which are common in computing+tech environments [17], [18], [46]).

People have differing opinions of DEI based on their perspective and experiences. For example, the experiences of women in computing vary in comparison to men. Historically disenfranchised groups (i.e., Black, Latinx, Native American, and Pacific Islander) have perspectives that contrast those of Whites, given their differing experiences with and exposure to issues of discrimination and oppression [54]. In addition, women from historically marginalized groups may view DEI from a different perspective than White women, due to the former's intersectionality of race and gender [11], [32], [37], [52]. Even further, women of color may view DEI differently based on their race/ethnicity. It's important to not only understand that diversity includes a number of different factors, but also that understanding and appreciating all factors are critical for an inclusive environment.

2.2 Cultural Self-Assessment (Awareness)

One of the most critical (and often uncomfortable) components of cultural competence is accurately and exhaustively assessing one's current beliefs against current practices. One may value diversity and still display bias and discriminatory behavior. Given one's perspective, it may be difficult to identify beliefs and practices as biased or discriminatory unless attention is brought to understanding why these are problematic. Research notes how many individuals who consider themselves majority allies are often unaware of their own biases [12]. This work coins the term "allersary" to describe such individuals as those who consider themselves majority allies, yet still exhibit toxic traits that are adversarial.

2.3 Management of Dynamics of Difference (Skill)

Cross describes "dynamics of difference" as "(w)hen a system of one culture interacts with a population from another, both may misjudge the other's actions based on learned expectations" [12]. Having good intentions around DEI doesn't mean one can appropriately manage differences that exist in cross-cultural communication. Not only is self-assessment of one's own biases critical, it is also important to recognize that interactions with individuals with different identities may not be received as

intended. In these instances, it is important to understand the relationship history between one's own identity/culture and the other party's, especially for those in majority demographic(s) [12]. Proper communication means understanding the historical impact of certain actions, words, and beliefs on people from diverse backgrounds, acknowledging these, and working actively to address and minimize misjudgements based on them.

2.4 Institutionalization of Cultural Knowledge (Knowledge)

Learning more about various cultures helps to eliminate issues that stem from an ignorance of cultural differences, including biases, stereotypes, and cultural appropriation. However, the acquisition of cross-cultural knowledge is not a one-time event. The transfer of knowledge after one conversation, workshop, or course does not equate to the institutionalization of that knowledge. Like any other knowledge or skill development, it requires continued learning, engagement, and practice in order to develop proficiency.

Institutionalization must occur across all organizational levels and provide research and demonstration projects to all stakeholders. Especially important is that "avenues to such knowledge are as important as the knowledge itself" [12]. This means that individuals from the respective cultures must be the primary contributors when addressing culturally related questions and concerns.

2.5 Adaptation to Diversity (Skill)

Organizational or individual approaches to diversity must be adapted to better meet the needs of people from all backgrounds. There is no one-size-fits-all approach to DEI. Just as individuals from different cultures have different beliefs and experiences, organizations and individuals should ensure that their cultural competence values, respects, and addresses the needs of all individuals.

3 Stages of Cultural Competence

Cross et al. defined six stages to assess an individual or organization's cultural competence. These stages (illustrated in Figure 1) are described below.

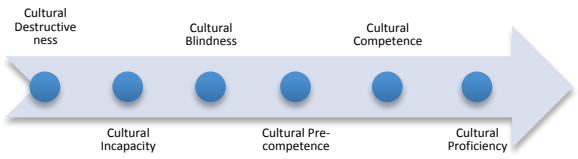

Figure 1: Cross et al.'s six stages of cultural competence

3.1 Cultural Destructiveness

This is the most negative and least proficient stage of the continuum. This stage is characterized by "attitudes, policies, and practices that are destructive to cultures and consequently individuals within the culture" [12]. Examples of cultural destructiveness include homophobia, misogyny, and White supremacy.

3.2 Cultural Incapacity

This stage includes organizations or individuals who are not intentionally destructive, but lack any capacity to properly help marginalized groups. Cross et al. assert this is characterized by "ignorance and unrealistic fear of people of color" [12]. However, this can also include unrealistic fears of people based on sexual orientation and religion, for example. Examples of cultural incapacity include discriminatory hiring practices, racial microaggressions, and lowered expectations of marginalized groups.

3.3 Cultural Blindness

This stage is characterized by ignoring cultural strengths and encouraging assimilation [12]. Individuals at this stage are considered allersaries. They believe that they are unbiased. They also insist that they don't see differences (e.g. race, gender, religion, etc.) and everyone is the same. However, they are also ignorant to the problems that these "culture-blind" beliefs create. Of particular note is that this stage frequently incorporates victim blaming, specifically in the lack of understanding why marginalized groups cannot improve their current situations, given that their beliefs that everyone is the same and has the same access to opportunities. Success for individuals at this stage is measured by how closely marginalized groups can approximate middle-class, non-minority existence.

3.4 Cultural Pre-Competence

This is the first stage that is considered positive action. Individuals and organizations realize their deficits and attempt to improve upon them. This stage is characterized by active and intentional efforts, including hiring of candidates from marginalized groups, mandatory cultural competence training across the organization, and active recruiting of individuals from marginalized groups for advisory and board positions. Despite these positive actions, concerns in the pre-competence stage include a false sense of accomplishment and tokenism of marginalized groups.

3.5 Cultural Competence

This stage is characterized by clear, intentional, and working examples of all elements of a culturally competent system (Table 1). Organizations actively hire unbiased employees, constantly work to improve practices, and seek the expertise of marginalized groups to better assess how to meet their needs. Major components of this stage include an understanding of the effects of policy on practice and actively working to ensure that enacted policies support a diverse and inclusive environment.

3.6 Cultural Proficiency

This stage is the highest level achievable. Individuals and organizations are characterized as valuing culture in the highest of regards and constantly searching to add to their knowledge base through active research, development of new strategies, and publishing and disseminating results. Cultural competence is an important factor at every level of the organization, and this is clearly understood and demonstrated.

4 Rationale for Cultural Competence in Computing

The current state of DEI in not only the tech industry, but also university computing departments illustrates the need for inclusion of cultural competence in undergraduate computing curricula, which has the potential to:

- ***Appropriately respond to current and projected demographic changes***. By 2030, the U.S. Census Bureau predicts that one in five Americans will be age 65 and over and half of the population will identify as female; by 2044, more than half of all Americans will belong to a minority group; and by 2060, one in five people will be foreign born [9][21]. In addition, approximately 22% of the current U.S. population age five and older speaks a language other than English at home. These statistics demonstrate the various types of diversity that are and will be even more present in the country. Despite this diversity in the U.S. population, the tech industry and university computing departments are still overrepresented by Whites and Asians, which have prevailed historically as the dominant races and ethnicities in the field [49], [50]. According to the 2018 Taulbee Survey, Whites and Asians comprised approximately 68% of current undergraduate enrollment (Figure 2), 72% of the bachelor's degrees awarded (Figure 3), and 85% of computing faculty (tenured/tenure-track/teaching) (Figure 4)[10].

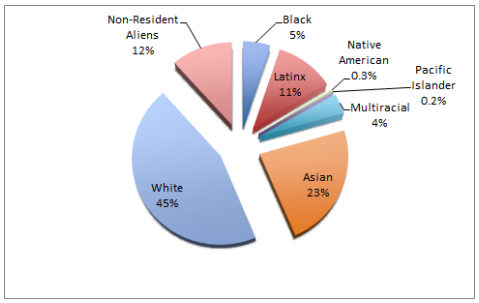

Figure 2: Undergraduate computing students enrolled, by race

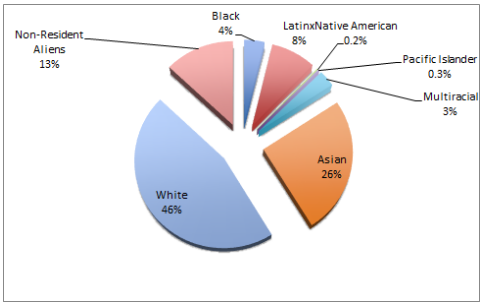

Figure 3: Computing baccalaureate degrees awarded, by race

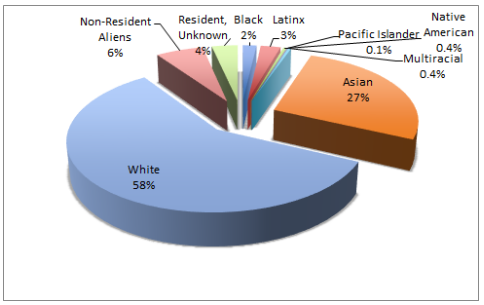

Figure 4: Computing faculty, by race

- ***Eliminate long-standing income disparities from diverse backgrounds***. Computer science majors earn $1.67M in lifetime earnings, compared to $1.1M for college graduates and $.58M for high-school graduates [5], [8]. As society becomes more technology-dependent, the lack of technical knowledge and ability to pursue computing careers places students lacking these requisite skills at an economic disadvantage that will continue to widen the "Digital Divide" as well as the wealth gap [4], [34].
- ***Improved technology development to account for differences***. Research has demonstrated the bias that is prevalent in many current technologies, including search algorithms, artificial intelligence, facial recognition software, and risk assessment in criminal justice [14], [15], [35], [36], [48]. The main reasons for these biases are the lack of inclusion of individuals from diverse groups in the development of these technologies and the inherent biases that these developers introduce into the development process.
- ***Decrease/eliminate the Quiet Crisis***. Computing is the only science, technology, engineering, and mathematics (STEM) field with more positions available than qualified graduates to fill them [5], [29]. Given the rise in cybercrimes, national security concerns have grown tremendously. These positions require U.S. citizenship and cannot be outsourced. Increasing the percentages of graduates from marginalized groups in computing provides additional qualified U.S. citizens in positions of increasing national importance.
- ***Improved retention of students and employees from marginalized groups.*** Research on retention of marginalized groups in computing notes a lack of sense of belonging as one of the contributing factors. Establishing an

identity in computing includes not only a sense of belonging, but also attachment to social group(s) and ethnically relevant role models [25], [39], [40], [42], [51]. Ethnic identity is directly linked to the self-efficacy and persistence of marginalized groups in career decisions. Increasing cultural competence will increase the identity of marginalized groups in the context of computing, thereby improving their entrance and retention in the discipline.

- ***Decrease likelihood of discrimination complaints and lawsuits***. Increased cultural competence will lessen the likelihood of discrimination complaints and lawsuits from students, faculty, and employees by ensuring that cross-cultural knowledge, communication, and engagements are rooted in clear understandings of differences between all parties.

Most corporate tech cultures benefit specific groups and marginalize others. As demonstrated in the discussion in section 4 (including Figures 2-4), this culture began in undergraduate computing departments nationwide, where the demographic representation mirrors that of industry. With no formal courses that focus on the non-technical issues impacting marginalized groups and how to address and eradicate them, students are indirectly taught that the current status quo in computing departments and industry is not only acceptable, but also unproblematic. This directly affects students from marginalized groups (as the reasons for attrition are similar in both higher education and industry), as well as faculty (as biased student evaluations directly affect hiring, promotion, and tenure decisions)[20], [33].

The lack of direct and intentional inclusion of cultural competence (including discussions of race, gender, intersectionality, bias, and discrimination in the computing workforce) continues to support corporate cultures that only favor the beliefs, practices, and identities of the majority demographic(s). If this is what students are taught and experience as undergraduates, then they will (like other computing fundamentals they are taught) continue to implement these same beliefs and practices upon graduation and workforce entry.

5 Proposed Implementation of Cultural Competence in Computing (3C) Program

5.1 Cultural Competence in Computing (3C) Assessment

The 3C Assessment measures the cultural competence of computing students and faculty. The assessment targets the four themes of cultural competence (attitude, awareness, knowledge, and skills), which also correlate with Cross et al.'s five elements of cultural competence (both are shown in Table 1). The 35-question tool requires participants to respond based on a four-point Likert scale (Strongly Disagree, Disagree, Agree, Strongly Agree) to reduce ambiguity. Responses are scored to identify the current stage of cultural competence based on the six-stage continuum (Figure 1). This tool can also be used as a pre- and post-assessment to gauge the progress of cultural competence development throughout a course or department. The tool, developed in 2019, is currently in the data collection and validation/reliability testing phase.

5.2 Race, Gender, and Computing Course

The "Race, Gender, and Computing" course is a three-credit hour course that is comprised of three parts:

- Part 1. Students are introduced to basic terminology such as race, ethnicity, bias, microaggressions, marginalization, and historically disenfranchised groups through various articles, publications, and current events related to the topics. It also discusses the non-technical differences in experiences between students from different races, ethnicities, and genders. Examples of how these challenges appear in public, classrooms, departments, campuses, and companies and their impact are also discussed. The primary goal of this section is to understand the terminology and challenges present in cross-cultural interactions, including their non-technical impact.
- Part 2. Students focus on the biases in technology development that are a direct result of the non-technical biases discussed in part 1. Topics include noted technologies that have displayed biases, why these biases exist, and how development could have properly addressed these issues. Similar to part 1, this section leverages publications, articles, and current events to understand the societal impacts of biased technology on various groups of people and the field as a whole.
- Part 3. The course culminates with an end-of-semester project, where students must select one book from a list to read (e.g., [14], [15], [35], [36], [48]) and present a reflection. This list is available to students on the first week of class. The required reflection should discuss the book, how it affected their perspective on DEI in computing+tech, and an implemented project to foster a more diverse, equitable, and inclusive environment.

The course, which targets sophomore-level students, leverages a blended approach of articles and books on DEI and bias in industry and academia, case studies, lectures, and class discussions. The course maps to the following student outcomes (Criterion 3) of the 2019-2020 ABET Computing Accreditation Commission requirements [1]:

- Outcome 3-Communicate effectively in a variety of professional contexts.
- Outcome 4-Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- Outcome 5-Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

It also corresponds to the following curriculum (Criterion 5) requirement:

- Local and global impacts of computing solutions on individuals, organizations, and society.

The course is currently under curriculum review for implementation at the author's current institution.

5.3 Additional Considerations

5.3.1 Credit Hour Considerations. While many computing departments struggle with accommodating the credit-hour requirements of the B.S. degree with the addition of new courses, some suggestions include infusing cultural competence across the computing curriculum to eliminate new course requirements. However, this approach does not ensure that proper emphasis is placed on understanding or addressing current DEI issues. As an example, programming fundamentals (e.g. loops, conditionals, and classes) are taught in stand-alone courses. Those constructs are then reinforced throughout subsequent courses, to ensure content mastery. Similarly, "Race, Gender, and Computing" should also be a stand-alone course, with the infusion of learned content into additional courses for reinforcement.

5.3.2 Faculty Accountability and Development. Proper institutionalization of cultural competence in university computing departments requires faculty development and accountability. However, this presents numerous challenges. Many of the issues that students from marginalized groups face stem from faculty interactions that include bias, microaggressions, and discrimination [43], [46]. Many faculty (85% of whom comprise the majority demographics in the tech industry) lack proper understanding of the challenges faced by people from different backgrounds, as well as how their own biases affect these groups. It is important for department chairs and administrators to require cultural competence of faculty in ways that support students and faculty from marginalized groups while protecting academic freedom. The 3C assessment should be required of all faculty, to gauge the department's level of cultural competence and identify strategies for improvement. Like social workers, educators, and healthcare practitioners, faculty teaching diverse students (especially those teaching "Race, Gender, and Computing") should meet a required level of cultural competence.

5.3.2 Industry Support. Tech companies have unique advantages concerning their engagement with academia. Not only do students desire employment, but faculty, departments, colleges, and universities desire funding through grants, donations, board of visitors and board of trustees positions, and more. This places the tech industry in a unique position to influence the DEI efforts of universities nationwide. Demonstration of how prospective interns and employees (students), faculty, and departments have fostered diverse and inclusive environments should be an expectation.

5.3.3 Differentiation Between Minority-Serving Institutions and Predominantly White Institutions. Regardless of institution type, the 3C program should be required for all computing undergraduates nationwide. Given the reasons for attrition of marginalized students, it's important for them to understand that while they may not experience certain challenges within their respective department/institution, they may face them in internships and full-time employment. Equally important is understanding how to identify and address algorithmic biases they may encounter in technical positions. The course will also allow students to understand cross-cultural differences and biases that may be present between students of color from different races/ethnicities.

6 Conclusion

As efforts continue to focus on creating a more diverse, equitable, and inclusive computing workforce, greater focus must be placed on creating more diverse, equitable, and inclusive university computing departments for both students and faculty from marginalized groups. Accomplishing this requires the introduction and requirement of cultural competence in computing to increase the development of majority allies and advocates. Successful implementation of this program has the potential to improve not only the retention of students and faculty from marginalized groups, but also their overall experiences in both academia and industry. By improving these issues before students complete baccalaureate computing degrees, companies will have talent pools that better understand the importance and necessity of DEI and also work to ensure they help foster more diverse, equitable, and inclusive environments and technologies. In addition, more students from marginalized groups will retained in the major through degree completion.

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