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Report to Faculty Development Committee : Development of Culturally Relevant Curriculum for Computer Science Courses and NSF's ITEST Grant

There were two defined objectives for "Development of Culturally Relevant Curriculum for Computer Science Courses and NSF's ITEST Grant"

1. Development of Culturally Relevant Curriculum for Computer Science Courses
2. Utilize the summer to finalize the grant writing process in order to apply for NSF's Innovative Technologies for Students and Teachers (ITEST) grant

Results:

Objective 1: Development of Culturally Relevant Curriculum for Computer Science Courses

Culturally relevant pedagogy is a framework defined by Gloria Ladson Billings, which has developed into many variations including culturally sustaining pedagogy and culturally responsive pedagogy. All of which utilize the existing culture and personal frames of reference of the students in the curriculum to enhance their educational experience. Culturally relevant computing (CRC) is the term used for practices that apply the pedagogical frameworks to the computing discipline. However, just like many of the other culturally relevant educational pedagogies, a recent review indicates that these practices are also not employed largely in higher education (Smarr and Gilbert, 2022). Smarr and Gilbert reported on the few attempts that have been made in common computing classes like Data Structures. The two reported practices used music and social justice as a lens to teach the curriculum. A Harvard-based pilot program chose to add ethics into various courses, which align with Billings' third tenet of culturally relevant pedagogy that addresses critical consciousness (Grosz et al., 2019). The table below was featured in the article, Embedded EthiCS: integrating ethics across CS education.

AREA	TITLE	CHALLENGES	ENROLLMENT
Introductory Courses	CS 1: Great Ideas in Computer Science	The Ethics of Electronic Privacy	76
	CS 51: Introduction to Computer Science II	Morally Responsible Software Engineering	283
	CS 109B: Advanced Topics in Data Science	Moral Considerations for Data Science Decisions	93
Theory	CS 126: Fairness, Privacy, and Validity in Data Analysis	Diversity and Equality of Opportunity in Automated Hiring Systems	11
CS and Economics	**CS 134: Networks**	Facebook, Fake News, and the Ethics of Censorship	162 (S'17); 21 (F'17)
	CS 136: Economics and Computing	Matching Mechanisms and Fairness	55
	CS 236R: Topics at the Interface of Economics and Computing	Interpretability and Fairness	24
Programming Languages and Computer Systems	**CS 152: Programming Languages**	Verifiably Ethical Software Systems	79
	CS 165: Data Systems	Data and Privacy	25
	CS 265: Big Data Systems	Privacy and Statistical Inference from Data	12
Human-Computer Interaction	**CS 179: Design of Useful and Usable Interactive Systems**	Inclusive Design and Equality of Opportunity	62
Artificial Intelligence	**CS 181: Machine Learning**	Machine Learning and Discrimination	296
	CS 182: Introduction to AI	Machines and Moral Decision-Making	164
	CS 189: Autonomous Robot Systems	Robots and Work	20

After reviewing both articles, as well as some others, including one featuring The Kapor Center's framework for Culturally Responsive-Sustaining Computer Science Education, I began to make a list of the classes offered in Lincoln's Computer Science catalog and decided to choose three courses: CSC 359: Introduction to Computer Security, CSC 457: Introduction to Computer Networks, and CSC 454: Software Engineering to design culturally relevant modules for. I chose the first two primarily because I have been teaching those courses for the last three years. For both CSC 359 and 457, I examined my previously existing syllabus to identify what topic could be a potential area for a culturally relevant module. For CSC 457, at the end of the semester, I cover Emerging Trends in Networking. Some current trending topics related to networking includes the widespread coverage and access (and lack thereof) of technologies such as 5G and wifi.

Sample Module Implementation for CSC 457:

In discussing the advancements of the seemingly pervasive cellular and wireless technologies, it is important for students to be aware that not all communities are as fortunate to have "instant" access to such technologies. For this module, articles and videos will be utilized so that students can comprehend the "digital divide", a term coined over two decades ago to describe the disparity between "those with ready access to the tools of information and communication technologies, and the knowledge that they provide access to, and those without such access or skills (Cullen)." This module will look at the existing digital divide in low income, Black and African communities as these are largely representative of students within the university's computer science department. After imparting knowledge with students, the students and faculty will participate in an open discussion about the lack of access to such technologies can impact various household members and what role they believe the government and internet service providers (ISPs) should play (Component 1 and 4). If possible, a member of the Greater Philadelphia area's Office of Innovation and Technology will speak to the students about the impact of the digital divide as well (Component 5 and 6). In terms of assessment, students will choose a creative means (i.e. Tik Tok/ Powerpoint) of sharing information with their peers. Their deliverable will focus on a type of community of their choosing highlight the digital divide, its impact, and a possible solution to the problem in the attempt to bring awareness to an often overlooked issue (Component 4).

The components in the aforementioned section relate to the Kapor Center's Framework (Center, 2021). The components (listed below) are paired with courses of actions and suggestions for educators to incorporate them into their curriculum:

1. Acknowledge Racism in CS and Enact Anti-Racist Practices
2. Create Inclusive and Equitable Classroom Cultures
3. Pedagogy and Curriculum are Rigorous, Relevant and Encourage Sociopolitical Critiques
4. Student Voice, Agency, and Self-Determination are Prioritized in CS Classrooms

5. Family and Community Cultural Assets are Incorporated into CS Classrooms
6. Diverse Professionals and Role Models Provide Exposure to a Range of CS/Tech Careers

Although the Kapor's Framework was written for K-12 CS education, I found their components easily integratable into the courses I initially developed the modules for as well. I was able to plan an implementation modules for three classes mentioned and intend to share my suggestions via a paper submission on the curriculum development to the 2023 RESPECT (Research in Equity and Sustained Participation in Engineering, Computing, and Technoloy) Conference.

Objective 2: Finalizing NSF's ITEST Grant Proposal

The summer months were used effectively for revamping and submitting the ITEST grant to the NSF. In 2021, I submitted a grant to the NSF's CS for ALL call for proposals. After attending a workshop that assisted on grant writing which featured reviewers for various NSF grants, I decided to resubmit the rejected grant idea to another sponsored program, Innovative Technologies for Students and Teachers or ITEST. The original grant proposed the development of a block based programming culturally responsive technology for 4th and 5th grade Black students. The tool will use block-based programming and Python to introduce students to foundational CS and CT concepts, such as conditional statements and decomposition. The culturally responsiveness will be incorporated by using cultural frames of references to create a narrative in which the topics will be taught. Additionally, the technology will feature a section that highlights prominent African Americans in STEM as well as draw attention to age-appropriate inequities as it relates to race and technology. The grant will provide funding to support undergraduates year round in conducting the research to develop the aforementioned technology.

I applied feedback from the CS for All reviewers, as well as those from the workshop, and made various changes to the proposed technology, including narrowing down the scope of the topics and including more existing theoretical support. Unfortunately, this attempt was also rejected. I intend to still move forward with the project by either soliciting funding from various smaller agencies and foundations to support the different phases of the project or finding an even better fit for the project through another NSF program; a reviewer stated that it may not have been best fit for the ITEST solicitation.

References:

Center, Kapor. "Culturally responsive-sustaining computer science education: A framework." (2021).

Cullen, Rowena. "Addressing the digital divide." *Online information review* 25, no. 5 (2001): 311-320.

Grosz, Barbara J., David Gray Grant, Kate Vredenburgh, Jeff Behrends, Lily Hu, Alison Simmons, and Jim Waldo. "Embedded EthiCS: integrating ethics across CS education." *Communications of the ACM* 62, no. 8 (2019): 54-61.

Smarr, Simone, and Juan Gilbert. "Higher Education Computing Curriculum for the Black Community: A Review." In *2022 ASEE Annual Conference & Exposition*. 2022.