What do CS teachers think about Culturally-Relevant Computing?

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Abstract: This presentation reports a mixed-methods study examining how in-service Computer Science (CS) teachers working in Hawai'i perceive the concept of culturally-relevant computing. Data for the study came from a survey sent to CS teachers ($n = 19$) and focus group interviews with a subset of respondents ($n = 10$). Analysis of the data revealed a snapshot of teachers' beliefs about culturally-relevant computing, as well as their current practices related to culturally-relevant pedagogy in the domain of CS. Detailed findings will be presented along with a discussion of the considerations and challenges in-service teachers face when planning and implementing culturally-relevant CS lessons. –

Introduction

Calls for increased Computer Science (CS) learning opportunities in K-12 classrooms have been issued repeatedly at local, national, and international levels. In response, a growing number of school districts now include CS education as a required subject (Tissenbaum & Ottenbriti-Leftwich, 2020). These requirements have raised concerns about shortages of qualified CS teachers (Shein, 2019) and the reality that many educators are being asked to teach CS with minimal formal training.

Research has shown that without formal training in CS education, teachers tend to face many challenges, including pedagogical issues, lack of community, and little understanding of course content (Yadav et al., 2016).

This has created a situation where in-service teachers need in-depth professional development and ongoing support, coaching, and mentoring (Cuny, 2012). A challenge for school districts interested in providing these supports is finding ways to connect CS education to existing instructional goals and curricular frameworks (Century et al., 2013; Qian et al., 2018).

One promising approach to making such connections is *culturally-relevant pedagogy*, which Ladson-Billings (1994) defined as using "cultural referents to impart knowledge, skills, and attitudes" (p. 17-18), ultimately empowering students intellectually, socially, emotionally, and politically. Such an approach to teaching values explicit connections between students' home culture and the subject matter they are learning (Gay, 2010; Ladson-Billings, 1995). Evidence suggests that culturally-relevant approaches to teaching can result in increased motivation for learning and improved academic achievement (Boutte, et al., 2010; Capper, 2021; Langlie, 2008).

In CS education, related work has focused on *culturally-relevant computing* (Eglash et al., 2013; Kafai et al., 2014; Madkins et al. 2019; Nakajima & Goode, 2019; Scott et al., 2015; Scott & White, 2013). According to Kafai et al. (2014), culturally-relevant computing leverages local practices of ethnocomputing to make explicit the mathematical and computational principles already present in the cultural practices of particular groups. Such ideas have led practitioners and researchers to develop CS-related activities and resources that are culturally-relevant for learners (Buechley et al., 2007; Scott & White, 2013; Nakajima & Goode, 2019). Empirical research on the topic of culturally-relevant computing has shown increased student engagement and academic performance (Franklin et al., 2011; Martin et al., 2017; Mejias, 2018; Scott & White, 2013).

Current Study

Although culturally-relevant approaches to CS education show great potential, much of the principles and processes of how to make CS lessons culturally-relevant remain unknown. To help address this need, a team of researchers at a public university in Hawai'i are engaged in a three-year, researcher-practitioner partnership with the Hawai'i State Department of Education. Funded by the National Science Foundation, this partnership aims to examine how culturally-relevant computing can support CS education at the elementary level. The partnership's practical goal is to provide elementary educators the resources and preparation needed to integrate culturally-relevant computing into their teaching. The partnership's research goal is to improve the field's theoretical and practical understanding of how culturally-relevant computing prepares educators to promote valued CS and culture-based education outcomes.

As part of the early work needed to achieve these long-term goals, the research team conducted an initial study to examine the current state of culturally-relevant computing in Hawai'i. The purpose was to understand *how* in-service CS educators working in a diverse multicultural context think about culturally-relevant computing.

As a first step, a brief survey was distributed asking in-service CS educators asking them about their perceptions and beliefs regarding culturally-relevant computing. The survey was designed to capture a snapshot of the "current state" of culturally-relevant computing practices in Hawai'i. More specifically, participants were asked to agree or disagree with the following statements using a five-point, Likert-scale (1 = strongly disagree; 5 = strongly agree):

- I value Computer Science lessons and resources that are culturally-relevant.
- I believe Computer Science lessons and resources that are culturally-relevant are more likely to help students learn (compared to lessons and resources that are NOT culturally-relevant).
- I feel existing Computer Science lessons and resources are culturally-relevant.
- I'm interested in learning more about how to make Computer Science lessons and resources more culturally-relevant.

A total of 20 teachers ($n = 20$) responded to the survey. The overall average across all items was 3.80 ($SD = 1.12$) out 5.00. The statement that showed the strongest agreement read, "I value Computer Science lessons and resources that are culturally relevant" ($M = 4.21$, $SD = 0.95$). The statement with the lowest agreement was, "I feel

existing Computer Science lessons and resources are culturally-relevant" ($M = 2.85$, $SD = 0.88$). See Table 1 for more detail.

Table 1: Culturally-Relevant Computing Snapshot Poll

Statement	*M*	*SD*
I value Computer Science lessons and resources that are culturally-relevant.	4.2	0.95
I believe Computer Science lessons and resources that are culturally-relevant are more likely to help students learn (compared to lessons and resources that are NOT culturally-relevant).	4.1	1.02
I feel existing Computer Science lessons and resources are culturally-relevant.	2.85	0.88
I'm interested in learning more about how to make Computer Science lessons and resources more culturally-relevant.	4.05	1.10

These results suggest teachers have positive views about culturally-relevant CS teaching; however, when it comes to current practices and existing culturally-relevant lessons and resources, the teachers felt less certain.

The survey results acted as a catalyst for the next step in the research process: conducting focus group interviews to better understand in-service teachers' perspectives on culturally-relevant computing. Using a participatory design approach (Spinuzzi, 2005), a total of ten in-service educators from public and private K-12 schools in Hawai'i participated in one of three focus group interviews. During the 60-minute interviews, participants were asked to share and reflect on their understandings of the concept, process, and principles of culturally-relevant computing.

Thematic analysis of the interview data revealed a number of relevant findings and recommendations. For example, the study found that educators A) value CS lessons and resources that are culturally-relevant and, B) believe CS lessons and resources that are culturally-relevant are more likely to help students learn (compared to lessons and resources that are NOT culturally-relevant). Despite these values and beliefs, however, the majority of educators did not feel existing CS lessons and resources are culturally relevant. They also felt more work is needed to support practitioners interested in making CS education more relevant and culturally-appropriate for students.

Conclusion

A number of important questions emerged as a result of the study. One of these questions has to do with "what should drive what"– in other words, what does an optimal balance of CS and culture look like in a culturally-relevant lesson? How can lessons and resources be designed and implemented such that dilution of either topic can be avoided? Clearly, additional research will be needed to address such questions and understand how teachers with varying levels of experience with CS and culturally-relevant pedagogy implement the same lessons and resources.

In conclusion, the authors feel the results of this study will be relevant to practitioners and researchers at EdMedia interested in CS education and/or culturally-relevant pedagogy. In addition to providing a detailed overview of the current study's findings and implications, the presentation will provide an overview of ongoing challenges and successes related to integrating culture into CS education. The session will end with an open discussion related to attendees' experiences integrating cultural learning outcomes into CS lessons and resources.

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