An Exploration of the Intersection between Black Music and Teaching Computer Science for iConference 2017

Stephy Oge¹, David James², Carolyn Jung³
¹University of South Florida
²Loyola University Maryland
³University of California, Irvine

Abstract
This poster recognizes the overarching need for multiculturalism in the field of computer science and related fields. After identifying key themes in the literature, we seek to explore the links between culturally relevant pedagogy and computer science, using Black music with college students. Data will be collected from pre- and post-surveys given to students in an introductory computer science course. Participants will be freshmen and sophomores not in computer science majors at a small mid-Atlantic liberal arts university. The practical implications of this quantitative study are to examine the best practices of teaching computer science to college students to increase ethnic inclusiveness in the field of computer science.

Keywords: Culturally relevant pedagogy; diversity; higher education; Black music


Copyright Copyright is held by the authors.
Contact stephyoge@mail.usf.edu

1 Introduction

Though people of all backgrounds use computing in their daily lives, computer scientists fall short of reflecting the racial and ethnic diversity of people in the United States. The Bureau of Labor and Statistics reported that in 2015, 8.6% of Black/African Americans, 19.6% Asians, and 6.8% Hispanic/Latinos have professional occupations related to fields in computer science and mathematical fields across the nation (Labor Force Statistics, 2016). The literature shows previous researchers have explored the interest young students have in learning computer science concepts with music in order to add diversity to the field. There are few studies of researchers teaching college students computer science concepts in a culturally relevant context. The purpose of this proposed study is to explore the intersection between Black music and Computer Science to teach college level students. In this study, Black Music will be defined as music produced and/or inspired by black people who live in America, including Jazz, Hip Hop, Soul, and Rhythm & Blues (R&B).

2 Research Questions

This study will explore the links between computer science and Black music in order to teach college students fundamental computer science concepts. The study will attempt to answer the following questions:

a) How has Black music been used to teach introductory computer science concepts?
b) What kind of impact has this teaching method had on students?

We have chosen Black music as the cultural context to teach students because African Americans are underrepresented in the computer science workforce in the U.S. (Labor Force Statistics, 2016). Black music is an extremely common component in American music. Over a third of the most popular 100 songs today
are made by or feature a Hip-Hop or R&B artist (Billboard, 2016). In addition, a genre such as Hip Hop utilizes techniques like looping and sequencing that directly relate to computer science concepts.

3 Methods

Our search of relevant literature took place from July to August 2016. We searched databases including ACM Digital Library, Google Scholar, Gale Computer, IEEE Xplore, and SCOPUS. Keywords searched included:

- Culturally relevant pedagogy AND Computer Science
- Culturally sustaining pedagogy AND Computer Science
- Computer Science pedagogy AND music
- Hip Hop AND Computer Science
- Hip Hop pedagogy AND Computer Science

The keywords searched are established theories and methodologies used by scholars in education, to teach content in a way that represents the identity and culture of students in an ethnically diverse classroom (Hill, 2009; Ladson Billings, 1995; Paris, 2012). We will provide a pre-survey to freshman students who are not computer science students (undecided or in other fields) to determine their level of interest in computer science as a career option or major. We will then teach a unit on algorithmic thinking, by having the students write an algorithm to create a remix, by rearranging samples from a Hip Hop song to emphasize the links between Black music and computer science concepts. After the unit, the students will complete a post-survey gauging their level of interest in the field (or lack thereof) to understand whether students’ attitudes toward computer science changed based on the cultural context of Black music. The purpose of the pre- and post-surveys is to measure whether the incorporation of black music into the computer science curriculum can have an impact on the diversity of students willing to take further computer science coursework or change their career path. Ladson Billings (1995) states that culturally relevant pedagogy rests upon three propositions:

- “Students must experience academic success;
- students must develop and/or maintain cultural competence; and
- students must develop a critical consciousness through which they challenge the status quo of the current social order.”

Academic success will be determined by post-survey results, examining each participant’s self-determined level of competency in computer science concepts introduced to him or her in the study. Cultural competence will be developed or maintained through the participant’s ability to identify one’s own cultural identity in relation to the teaching of computer science using Black music. In recognizing this relationship, each participant will reflect on the impact Black music had on his or her potential to consider computer science as an academic major or career path.

4 Findings

The relevance of the literature to our findings was determined by the keywords used in ‘Methods.’ Our review of the literature revealed three major themes. The first suggests programming is uninteresting to many students, but can be rewarding if taught in the context of music (Adams, 2012; Lapidot and Hazan, 2005; Margolis, 2012; Misra et al., 2009). In the study, “Song Debugging: Merging Content and Pedagogy in Computer Science Education,” Lapidot and Hazan (2005) sought to change the negative perception that underrepresented students had toward computer errors by teaching students to debug a program by playing a particular song to highlight the importance of computer science concepts. Similarly, Misra et al. (2009) found evidence of students learning better when content (in this case computer programming) is situated
in a particular context (music or robotics). With adequate tools, music can be a powerful means to engage students in introductory computer science courses, highlighting creative and analytical sides of computing. A creative task, such as making a robot dance, provides motivation to learn. A common goal in much of the literature involved making computer science more interesting to students.

The second theme identified in the literature proposes students can perceive programming as a tool to augment their ability to create art and music (Hamer & John, 2004; McCoid et al, 2013; Muller, 2015). In another study, “An Approach to Teaching Design Patterns using Musical Composition,” Hamer and John tasked students with composing music to teach design patterns through the use of programming (Hamer & John, 2004). Students were exposed to computer science concepts including loops, conditional statements, and statement sequencing. A group of researchers in a 2013 study, integrated a Python programming environment with a commercial digital audio workstation program, Cockos’ Reaper, to provide an environment to create music. They found that students were exploring programmatic techniques by composing their own music using commercial music production tools and completing simple music programming assignments (McCoid et al, 2013). Many of the educators in these studies allowed students to explore the depths of computer science programs and concepts while granting them the freedom to use their creativity to create music and art.

We discovered that many studies, where educators used culturally relevant pedagogy to teach computer science, were limited to high school aged students and younger, typically from underrepresented populations (Aaron & Blackwell, 2013; Dannenberg et al, 1984; Freeman et al, 2014; Guzdial, 1991; Leonard, 2014; Maloney, 2008; Washington, 2013). A study completed in the UK used two languages, Sonic Pi (a simple music making language for children in classrooms) and Overtone (a sophisticated functional language for live music making), to teach students aged 12 through 16 core computing concepts (Aaron & Blackwell, 2013). In “Engaging Underrepresented Groups in High School Introductory Computing through Computational Remixing with EarSketch,” researchers sought to recruit and increase retention of underrepresented students in high school computing courses through teaching culturally relevant computational music remixing on EarSketch, a popular composition form in Hip Hop music (Freeman et al, 2014). These researchers focused on the level of beats, loops, and effects requiring more than one note at a time, allowing students with no background in music theory or composition to create music. Another researcher experimented with teaching elementary students to code by allowing students to compose music using their ear to judge the results. Along the way, students learned the Logo programming language (Guzdial, 1991). Many of these researchers worked with younger students to create a fundamental knowledge base the students could use if they chose to further similar studies.

5 Discussion

The literature search revealed two major gaps in the studies where educators are using culturally relevant methods to teach computer science concepts. The first highlights a low occurrence of culturally relevant contexts used to teach introductory computer science concepts in higher education. Also, studies exploring the connections of a specific genre of music with computer science was uncommon. We plan to fill part of this gap by exploring ways to teach college students computer science concepts in a culturally relevant context through Black music.

It is important we do this work because it would provide an interesting element to teaching introductory computer science courses, attracting more underrepresented students to computer science. Having more diversity in this particular field would help the field reflect the diversity of the country. In 2014, Twitter disclosed a diversity and gender report of their employees. Surprisingly, women made up 10% of their technical team, while Black or African Americans made up 2% of their overall employees (Statt, 2014). The groups of people using technology and social media outlets are not the same groups of people creating the technology, maintaining the systems, and setting security limits. Although people of color
participate heavily on Facebook and Twitter, they are largely absent from development, engineering, and leadership roles in these companies.

6 References


