ENGAGING HISPANIC/LATINO(A) YOUTH IN COMPUTER SCIENCE: AN OUTREACH PROJECT EXPERIENCE REPORT

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ABSTRACT

Learning Computer Science through the Lens of Culture and Society is an outreach project that seeks to increase the participation of Hispanic/Latino(a) high school students in computer science. This project provided a one-week summer workshop that introduced high school students to computer science through hands-on activities involving computational thinking, Alice 3D animation, Android app development, and soft skills. Various activities of the workshop shared the theme of culture and society. This paper describes the motivations behind our project, the design of our workshop, and our evaluation results.

INTRODUCTION

Computing underlies many innovations that drive the national and global economy, and computer science graduates are much needed to supply our computing labor workforce. Current government projections show that by 2020 more than 758,000 high-end computing jobs will be created, making it one of the fastest growing occupational fields [1]. However, computer science college major enrollment has declined or flat-lined each year in the past decade, and U.S. universities will only generate enough graduates to fill less than a third of the computing job openings available by 2018 [2].

Like the population, the U.S. workforce is becoming more diverse. Among ethnic groups, persons of Hispanic/Latino(a) origin are projected to have the largest increase of their share of the labor force by 2010, from 14.8% to 18.6% [1]. Minority groups such
as Hispanics/Latinos(as) are underrepresented in computer science, with only 6.8% of computer science bachelor’s degrees awarded to Hispanics in 2005 [3]. Increasing participation of youth who have been traditionally underrepresented in computer science is important to building our high-tech workforce.

As a result, this outreach project was developed to increase the participation of Hispanic high school students in computer science and to encourage these students to explore higher education and careers in computer science [4]. Specifically, the project targets Hispanic students in San Bernardino County, which is 47% Hispanic. With the collaboration between Crafton Hills College, a Hispanic-serving community college in Yucaipa, CA, four high schools, and a four-year university in the local area, this project provided a summer workshop that introduced students to computer science and motivated them to explore this field. The project applied a number of exemplary practices compiled by the Computer Science Collaboration Project for engaging Hispanic/Latino(a) youth in computer science [5].

The specific goals and objectives of this project include:

- **To increase the participation of Hispanic/Latino(a) high school students in computer science:** This project provided a computer science workshop that engaged high school students representative of the cultural diversity of the project’s service area, targeted Hispanic/Latino(a) youth, and introduced them to computer science through hands-on, engaging activities. The workshop utilized and explored tools for teaching computer science, including Alice 3D animation programming and the Android mobile application development platform. It also incorporated culturally relevant activities and provided support to bilingual speakers.

- **To develop interactive, multilingual, and open learning modules that teach computer science theory and principles:** As a result of this project, computer science learning modules involving hands-on activities and real-world applications were developed. The learning modules, which had been translated to Spanish, are easily adaptable and freely available on the Web.

- **To encourage high school students to explore computer science educational programs and careers:** The project provided participants resources on higher education opportunities and possible educational pathways in computer science. In addition, it provided mentors and role models who share insights with students on pursuing higher education and careers in computer science. Family members of the youth participants were involved in the project to support students in exploring computer science.

**PROJECT DESIGN**

**Overview and Participant Recruitment**

This project implemented a one-week workshop during summer 2012. The events were held on Crafton Hills College campus. The summer workshop included presentations and hands-on sessions on:

- introduction of the computer science discipline
- hands-on programming projects using Alice and App Inventor for Android
- computational thinking
soft skills (teamwork and presentation)
computer science higher education and career paths
resources on student opportunities and on learning computer science and STEM (Science, Technology, Engineering, and Mathematics) subjects

The target participants were Hispanic/Latino(a) students from high schools in San Bernardino County. Bilingual informational materials in English and Spanish were developed and provided online and to the project’s partnering high schools, which promoted the project to their students. A number of local community organizations, including churches, community center, and library also assisted in promoting the project. To specifically recruit Hispanic/Latino(a) youth, the project staff contacted Catholic churches and distributed informational materials in Spanish markets in the area. The project’s high school partners were also asked to encourage underrepresented youth to participate.

**Workshop Activities**

Each participant was given a workbook containing the hands-on learning modules covered in the workshop and other resources on computer science education and careers. All workshop materials, including open, bilingual learning modules are freely available on the project’s web site [4]. Each day of the workshop included lunch as well as snack breaks in each three-hour blocks. Table 1 provided a list of the scheduled workshop activities.

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome Pre-survey Introduction to the CS discipline</td>
<td>Game activity: check-in and review Fundamental programming constructs</td>
<td>Game activity: check-in and review Software development process</td>
<td>Game activity: check-in and review Building Android apps</td>
<td>Finishing Alice/Android projects</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>Animation Programming in Alice</td>
<td>Introduction to Android with App Inventor</td>
<td>Building Android apps</td>
<td>Practice presentations Feedback and voting</td>
</tr>
<tr>
<td>Social media</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft skills: teamwork</td>
<td>Computational thinking</td>
<td>Invited talk by CS university faculty</td>
<td>Continuing Android apps</td>
<td>Resources on student opportunities Post-survey</td>
</tr>
<tr>
<td>Invited talk by industry education program manager</td>
<td>Student mentors sharing their paths to CS education</td>
<td>Creating Android games and apps</td>
<td>Fine-tuning Alice animated stories</td>
<td>Invited talk on CS education and career by university staff</td>
</tr>
<tr>
<td>Brainstorming</td>
<td>Creating stories</td>
<td>Brainstorming</td>
<td>Fine-tuning</td>
<td>Celebratory</td>
</tr>
</tbody>
</table>
Computer science concepts and principles, including programming constructs (e.g. data types, conditionals, control structures, functions), object-oriented programming, problem-solving, and algorithm design, were introduced using Alice, an innovative programming environment for 3D animation [6]. Research studies done by Carnegie Mellon University and others have shown Alice to be a positive tool for teaching computer science to middle school girls and college students [7, 8]. The participants used Alice as a storytelling tool to create animated stories with the theme of culture.

In addition to teaching computer science using Alice, the workshop included mobile app development using App Inventor, a web-based Android app development environment [9]. With mobile devices predicted to overtake PCs as the most common Web access device by 2013, this project aims to capitalize on the popularity of mobile devices as computing tools [10]. The workshop provided participants guidance throughout the software development process of mobile applications that solve real-world problems. Participants were encouraged to create games and applications that built on their interests while focusing on the needs of users. Through these hands-on activities involving engaging technologies and culturally relevant activities, the project hopes to help increase the participation of Hispanic youth in computer science.

Besides presentations and hands-on programming projects that introduce participants to computer science, the workshop also incorporated computational thinking learning activities. Participants explored visual and numerical patterns in everyday objects and fractals, as well as analyze charts and figures to identify patterns in society. They also learned about algorithms and designed algorithms for reaching personal goals and for planning their Alice animation on a storyboard.

During various workshop activities, participants worked in teams and programming projects through pair programming, which has been shown to be effective in retaining computer science students [11, 12]. Each team was led by a computer science college student, who assisted the participants throughout the workshop activities and served as mentors for the participants by providing insights into computer science higher education. The student mentors were from diverse cultural backgrounds, including one with Hispanic heritage. At the end of each day of the workshop, the college student mentors and the workshop facilitator held group discussion on strategies to best assist the youth participants.

A number of guest speakers from industry and local university shared their insights on computer science and learning resources with the participants. Two computer science faculty and staff members from University of California, Riverside discussed computer science higher education and career paths with the participants. In addition, an education program manager from Google presented various educational resources available to students interested in STEM subjects.
Involving Family Members

During each day of the workshop, participants were encouraged to reflect on and share their workshop experiences with their parents or family members. They also reported their reflect-and-share activities to their team leaders at the beginning of each day. The informal reflect-and-share activities were intended to help students reinforce the knowledge obtained in the workshop and to involve families throughout their workshop experience.

The workshop culminated in a project showcase and celebratory dinner in which participants presented their finished projects to their family members. This allowed parents and other key adults to better understand computer science and provide further encouragement to students to explore the discipline. Awards were presented to participants who were voted for outstanding animation, mobile app, and achievement, respectively. A Spanish language interpreter was available at the showcase and celebratory dinner to assist Spanish-speaking parents.

RESULTS

Participants

A total of 16 students in 8th to 12th grades participated in the workshop. The participants found out about the project from various sources: directly from their teachers (38%), friends (19%), information posted at school (13%), churches (13%), parents (6%), project staff (6%), and library (6%). Nine participants (53%) were of Hispanic/Latino(a) heritage, and six participants (44%) spoke both English and Spanish. Seven participants (44%) were female. Table 2 shows a summary of the participants’ demographic information.

Table 2 Participants' Demographic Information

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number</th>
<th>Percentage</th>
<th>Ethnicity</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>7</td>
<td>44%</td>
<td>Caucasian/European</td>
<td>8</td>
<td>47%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>American/White</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>56%</td>
<td>Hispanic/Latino(a)</td>
<td>9</td>
<td>53%</td>
</tr>
<tr>
<td>Grade Level</td>
<td></td>
<td></td>
<td>Other, please specify: Arabic</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>8th</td>
<td>1</td>
<td>6%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9th</td>
<td>2</td>
<td>13%</td>
<td>Only English</td>
<td>9</td>
<td>56%</td>
</tr>
<tr>
<td>10th</td>
<td>3</td>
<td>19%</td>
<td>Mostly English/Sometimes another language*</td>
<td>4</td>
<td>25%</td>
</tr>
<tr>
<td>11th</td>
<td>4</td>
<td>25%</td>
<td>Half English/Half another language*</td>
<td>2</td>
<td>13%</td>
</tr>
<tr>
<td>12th</td>
<td>6</td>
<td>38%</td>
<td>Mostly another language*/sometimes English</td>
<td>1</td>
<td>6%</td>
</tr>
</tbody>
</table>

* Spanish was specified as the “other language” for all participants.
The workshop facilitator was a faculty member of the lead college. Four college students from local colleges and universities served as team leaders and mentors for the youth participants. A total of 30 family members of the youth participants attended the celebratory dinner and project showcase at the end of the workshop.

Evaluation

The collaboration effort from the project’s high school partners recruited nearly half of the participants. Encouragements from friends and from youth ministry at Catholic church were also identified as referral sources of our Hispanic/Latino(a) youth participants.

Through creative animation and mobile app projects, participants applied the computer science knowledge and skills that they had obtained during the workshop. Working in teams, they designed storyboards and created Alice animated stories about different cultural themes, including the Mayan calendar, Hawaiian dance, Christmas, American football vs. soccer, and Egypt. Participants also created interesting Android apps and games of their own interests. For example, with his mother in mind, one student developed an app called “Mom’s Best Friend” that helps people take pictures of their coupons and store information about them. One student who is an avid swimmer, created an app that helps people learn about different swimming strokes. A number of students created their own games, and some developed everyday apps such as alarm clock and calculator.

Pre- and post- surveys were administered at the beginning and at the end of the workshop, respectively, to obtain feedback on the workshop and to gauge the participants’ level of engagement, as well as interest and attitude towards computer science.

Results of the post-surveys indicated that 81% of the participants attended all or nearly all of the program sessions. A few participants were not able to attend all the activities on the final day of the workshop due to personal and family reasons. 92% of the respondents expressed that they were mostly or very engaged in the program and its activities. The results also indicated that the participants were satisfied with their workshop experience: on the survey items about their experiences in the program and the positive effects the program had had on them (Table 3), the mean of each of those items is 4 or above (1 = strongly disagree, 5 = strongly agree). 100% of the respondents indicated that they would recommend the program to a friend.
Table 3 Participants’ Experience in the Program and Perception of the Program’s Effect on them

(1 = strongly disagree, 5 = strongly agree, Post-Survey Results n = 13)

<table>
<thead>
<tr>
<th>Post-Survey Item</th>
<th>Mean</th>
<th>Post-Survey Item</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>My participation in this program...</strong></td>
<td></td>
<td><strong>My participation in this program...</strong></td>
<td></td>
</tr>
<tr>
<td>I enjoyed the program and its activities.</td>
<td>4.69</td>
<td>increased my computer science skills.</td>
<td>4.62</td>
</tr>
<tr>
<td>The activities were related to my interests.</td>
<td>4.15</td>
<td>helped me understand what computer science is.</td>
<td>4.46</td>
</tr>
<tr>
<td>My goals for participating in this program were met.</td>
<td>4.38</td>
<td>helped me understand how computer science is important and useful. (n=12)</td>
<td>4.58</td>
</tr>
<tr>
<td>The content or activities were just right for my skills.</td>
<td>4.23</td>
<td>increased my interest in taking computer science classes.</td>
<td>4.62</td>
</tr>
<tr>
<td>The staff/adults of this program were knowledgeable.</td>
<td>4.62</td>
<td>made me more likely to consider a job related to computer science.</td>
<td>4.00</td>
</tr>
<tr>
<td>The staff/adults of this program cared about my success.</td>
<td>4.62</td>
<td>made me more confident in my ability to succeed in computer science.</td>
<td>4.54</td>
</tr>
<tr>
<td>I felt comfortable learning in this program.</td>
<td>4.77</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When asked about what they would change about the program if they were in charge, five respondents expressed that they would make the program longer. When asked about what they liked best about the program, seven of the respondents indicated Android app development. Snack breaks were also favored. Other responses included:

- “I liked learning new things. The mentors were very helpful and I feel that I learned a lot.”
- “I liked learning the basics of programming and being able to see what I created.”
- “I liked how to make the android application and the Alice program.”
- “Learning new things communicating with people who have experience.”
- “Meeting new people”
- “How we learned programming and being with people that had the same interests as me.”
- “Besides the breaks, the fact that we were allowed and taught in the process of making several things (movies/apps) as a team.”
- “The app design. I loved making the games.”

Finally, the college student mentors who worked with the youth closely throughout the workshop also found working in the project a positive experience. In the survey that they completed after the workshop, all four mentors expressed that they enjoyed working in the workshop and would recommend other computer science college students to participate.
CONCLUSIONS

The evaluation results of our workshop showed that the week of hands-on activities on learning computer science with the theme of culture and society was effective in helping participants understand what computer science is and in increasing their interest and confidence in further exploring computer science. In this project, the collaboration between different educational institutions (high school, community college, and university), community organizations, and industry was important in recruiting youth from diverse backgrounds and in engaging them with a variety of educational activities. We hope that by sharing our project experience, more collaborative effort from different organizations will be formed to provide outreach opportunities like this project in order to inspire youth to learn computer science and to increase the diversity of the computing workforce.

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REFERENCES


