Building a K-12 Computing Pipeline in Alabama that Addresses Participation Diversity

Jeff Gray, University of Alabama, Department of Computer Science, gray@cs.ua.edu
Shaundra Daily, Clemson University, School of Computing, sdaily@clemson.edu
Mike Wyss (PI: ITEST, BPC), UAB, Center for Community Outreach Development, jmwyss@uab.edu
Shelia Cotten (PI: DRK12), UAB, Department of Sociology, cotten@uab.edu

THE UNIVERSITY OF ALABAMA COMPUTER SCIENCE

UAB

CLEMSON HUMAN-CENTERED COMPUTING

ALADDIN

The Birmingham Consortium for Computer Education (Aladdin) focuses on training minority high school student cohorts in computer science, through a three years sequence of activities that build on each other, including:

1. Alice and game programming (summer before 10th grade)
2. Linear algebra focused on examples from the Alice experience (10th grade in-class)
3. Computer visualization in the context of Mechanical Engineering and Medicine (summer before 11th grade),
4. Introduction to robotics and Java (during 11th and 12th grade).

Participating teachers were trained in both Alice and linear algebra, to create a sustainable model.

Results
- Pre-/post-tests students show about 40% increase in IT content knowledge concepts, and a college-level understanding of linear algebra.
- Pre-/post-interest in IT careers greatly increased (most had little idea about potential careers before participating).
- Lessons learned inform their other school subjects (especially advances a systematic approach to their education and provides analytic skills).

iCAC

Integrating Computing Across the Curriculum

In 2008, Birmingham purchased 15,000 XO laptops and gave them to the elementary school students in the city's school district to promote IT education.

However, the city failed to implement a sufficient teacher professional development program (only about 2 hours offered per teacher). This lack of preparation resulted in negative attitudes towards the XOs, and a dearth of utilization of the platform in classrooms across the district.

Our objective has been to design, implement, and assess a structured intervention aimed at (1) teachers, (2) students, and (3) families that will enhance the students' understanding of STEM fundamentals by incorporating laptops into an inquiry-based educational process.

Selected Results
- The mean Teacher XO Skill Level increased from 1.17 to 2.04 (p<.001; scale range: 0-4)
- 90% of the teachers participating in institutes felt confident that they could design their own effective lesson plans and utilize the ICAC developed lesson plans in their classrooms.
- The training significantly increased teachers' perceived comfort in incorporating XO activities.

M3

Multi-tiered Mentoring Model

The multi-tiered mentoring model (M3) was created to foster excellence in grades 5-20 computer science education in the Birmingham area.

The goal of the BPC-M3 program is to provide sequential tiers of mentoring, by which the learner in one tier becomes the mentor-teacher to the next tier down. This model focuses on providing a more sustainable and effective pathway for students from underrepresented backgrounds to pursue careers in computing.

Approach
At each tier of this model (college, high school, middle school), students learn to program in Alice, CS Unplugged and robotics. The college and high school student-mentors learn about how to communicate their knowledge to the next tier of students.

Challenges
- Classroom social architecture not conducive to inquiry-based activities.
- Effectively managing external resources (e.g., allowing students to appropriately use the internet to find content for their projects).
- Ensuring that the participating teachers at the high school become and remain engaged.

NSF