Recruiting Diverse Learners to High School Computer Science

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ABSTRACT

This presentation highlights strategies for improving recruitment and engagement of under-represented students into high school (HS) computer science (CS) classes. Operating within the collaborative structure of a researcher-practitioner partnership (RPP), the CS diversity, equity, and inclusion (DEI) strategies were conceived by members of the Rutgers Computer Science Teaching & Learning Collaboratory (CS-TLC), an NSF-funded RPP specifically established to build the capacity of schools to provide rigorous, inclusive CS education (CSE). Through an audit and reflection on current practice coupled with a synthesis of major findings from the education literature, CS-TLC formulated a three-pronged strategy to address equitable student recruitment - (i) tailoring communication and outreach activities, (ii) revisiting and updating relevant institutional practices or policies that directly or indirectly impact recruitment and engagement, and (iii) enhancing existing instructional practices. The presentation will preview each of these approaches, share preliminary qualitative evidence regarding their efficacy, and highlight the benefits of working within an RPP to conduct such work.

CCS CONCEPTS

• **Applied computing → Education**.

KEYWORDS

CS Education; K12 Education; Equity; Underrepresented Minority Students; Low-Income Students; Student Recruitment; RPP

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1 MOTIVATION

Inequity in CS is profound and widespread [1]. Research shows that experiences students have in K12 math and science strongly influence their decision to choose a STEM major and impacts their self-efficacy, motivation, and resilience [2]. Additionally, students – particularly low-income and minority - who were more engaged in technology-based learning activities were more likely to choose a STEM major [3]. Increasing DEI in CSE will ensure that CS-dependent industries benefit from the insight, talent, and expertise of a diverse and inclusive workforce [4], and that consistent progress is made on addressing a range of social justice issues [5].

2 METHODS AND PRELIMINARY RESULTS

CS DEI recruitment and engagement strategies were conceived based on engaging all partners in CS-TLC in an audit and reflection on current practices, with guidance from the relevant literature on CSE and other STEM fields. Discussing and debating these ideas within the RPP ensured they were vetted by practitioners and took into consideration diverse perspective of educators serving under-represented student populations. Members of CS-TLC compiled and reviewed current plans and activities for recruiting and engaging students from under-represented groups in CSE and identified priority areas to address, including the following: (i) *improving communication and outreach* requires better tailoring (or personalization) of recruitment-related communication and other activities in ways that emphasize the relevance of CS to the interests and experiences of students from under-represented groups while emphasizing the opportunities afforded by CSE; (ii) *revisiting and updating institutional practices or policies* related to enrollment in CS courses to allow for greater flexibility in scheduling CS courses, eliminating or minimizing the prerequisite requirements to allow students to more easily enter the CS pipeline, and increasing the role of guidance counselors in diverting students to CS classes; and, (iii) *enhancing instructional practices* by adopting culturally responsive teaching methods, integrating CS concepts into the general curriculum, and creating opportunities for students to contribute to collaborative problem-solving projects where CS competencies are being taught.

3 CONTRIBUTION AND FUTURE WORK

These strategies are currently being implemented, with process evaluation ongoing. The initial phase of evaluation focuses on qualitative assessments of the implementation experience to identify key facilitators and barriers. The next phase of the evaluation will actively seek to engage a broader group of educators to assess the suitability and potential adaptability of these strategies to elementary and middle schools.

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Methodology

The RPP mechanism affords educational partners an avenue to explore best practices and strategies as presented in academic and practitioner published research. It also provides the opportunity to share actual practices being used in the field around these same issues.


Communication & Outreach


Institutional Practices


Instructional Practices

Through conversations with teachers, administrators, guidance counselors, and other stakeholders, combined with insights gleaned from RPP meetings, semi-structured interviews, and an inventory of internal online forums, we have compiled past experiences, current practices, and future plans into a three-tiered approach to recruit and retain diverse students in CSE.

Communication & Outreach
- Outcomes-focused
- Credible and valued source
- Platforms for high engagement

Institutional Practices & Policies
- Remove barriers
- Increase awareness
- Increase exposure to CS

Instructional Practices
- Cross-curricular engagement
- Collaborative learning
- Inclusive classroom practices
- Culturally relevant pedagogy

Increased DEI in CS Courses
- Increased self-efficacy
- Increased achievement
- Consideration of CS careers/education

Increased DEI in CS Workforce
- Bring unique and necessary knowledge, skills, and abilities

Background

Inequities in computer science education (CSE) are profound and widespread. Increasing diversity, equity, and inclusion (DEI) in CSE ensures that:

- Industries benefit from diverse perspectives
- Progress is made in addressing social justice issues
- CS workforce will see greater diversity & representation

Given the importance of proactive and intentional recruitment of historically underrepresented students to CSE, we have leveraged our work within a researcher-practitioner partnership (RPP) to explore recruitment strategies that are both being used and/or have been shown to be productive in practice.

Communication & Outreach

Area	Key Ideas	Practices
Effective Communication Design for Information Interaction	Know your Community, Audience	Meet audience where they are Communicate based on their needs, experiences, predispositions, goals, and values Effective communication is relevant, timely, trusted, and actionable Tell your audience why they should care about the topic and what they can do
	Use the Right Tools	Create properly "packaged" messages Use emotional appeals, fact sheets, or other information as needed Use a source and channel that will reach and engage most of your audience Consider sending personalized letters home or hand-delivering flyers
Tailoring Communication & Messages	Audience Analysis	Assess audience knowledge, beliefs, and expectations for CS learning Focus on what outcomes are valued by the audience
	Audience Segmentation	Segment your audience based on their roles and results of audience analysis Create communications tailored to each partition of the audience Consider what forms of media each group interact with and what they respond to

Institutional Practices & Policies

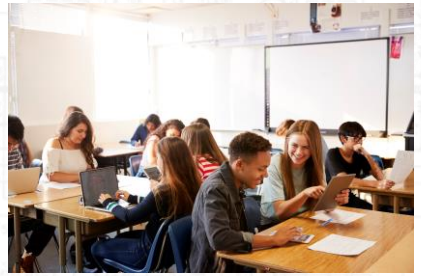
Area	Practices
Access, Prerequisites, & Sequencing	Begin recruiting 8th graders to high school CS through course planning Purposefully reexamine the necessity of exiting pre-requisites Ensure that course sequencing allows options for student choice and no "dead ends"
Status & Branding of CS Courses	Place CS courses in course scheduling systems/catalogs in an easy-to-find place Consider renaming CS courses to accurately reflect content and recruit students Leverage connections with guidance counselors to make students aware of what CS is, and what it isn't
CS Curriculum & Pathways	Provide spaces for MS and HS teachers to collaborate on creating a continuous CS pathway to retain students Design course pathways that include wide-reaching, varied entry points to CS Mindfully articulate curriculum across courses to avoid repeated material while preparing students to progress along course sequences
Student & Parent Engagement	Grow community culture and beliefs around CS through outreach events Create accessible, inviting spaces for parents to learn about CS and its possibilities Support after-school clubs and organizations to build excitement Establish and maintain partnerships with neighboring districts, higher-education, and industry

Instructional Practices

Area	Practices
Recruit from Inside & Outside the Classroom	Utilize unplugged activities to cultivate a computational thinking mindset Incorporate CS concepts outside the classroom to reach larger audience (clubs, events) Engage students in collaborative work such as pair programming
Cross-Curricular, Project-Based Coursework	Work with teachers to bring CS into classrooms in other subject areas Allow students the space to bring their own interests to their work in CS Utilize culturally—responsive pedagogies and tools to reach and retain typically underrepresented students

How can you "program" your partner to paint or draw a specific image?
Art

How can we code and decode messages? (symbolism, favorite quotes, etc.)
English



How could Napoleon use graph algorithms to optimize conquering Europe?
History

How can we code a repetitive song on paper? Is sheet music just code?
Music

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