

Recruiting Diverse Learners to CS Education

Cynthia Blitz, Vivian Allen, and David Amiel
Center for Effective School Practices
Graduate School of Education
Rutgers University | New Brunswick

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Practical Strategies and Techniques

recruiting diverse learners to computer science education

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Communication

Institutional Practices

Outreach

Instructional Practices

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Design for Communication

know your community, know your audience

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Design for Communication (Plan)

Know Your Audience/Community

- Power to make change lies with your target audience
- Meet audience where they are (audience segmentation) based on their needs, experience, 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 to help the cause

Use the Right Tools

- Once you figure out what you want to convey to your target audience
- You need –
 - Credible source to deliver the message (this can be students themselves)
 - A properly “packaged” message (for example, use of emotional appeals)
 - Channel that will reach the majority of your audience (letters sent home get more attention than blast emails)

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Tailoring Communication

Audience Analysis

- What does my audience already know (or not) about the topic?
- What does my audience believe about the topic (e.g., causes of inequity, possible fixes, etc.)
- What are my audience expectations regarding the program/initiative?
- What outcomes are most valued by my audience?

Audience Segmentation

- Segment audiences based on their role (e.g., internal and external stakeholders)
- Segment audiences based on knowledge, comprehension, and beliefs – not demographics
- You can also segment target audience based on their motivation and/or their interest in actively supporting the program/initiative

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Tailoring Messages

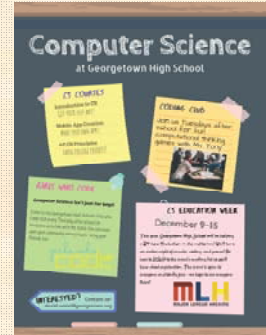
- Make sure that what you say resonate with the values and experience of your audience (talk from the perspective of your audience)
- Communicate with your audience as you would with a partner, not a client
- Factual information often works better than telling a story
- It is often helpful to provide information about what other audience members think and do about the topic (to signal the norm)
- Avoid prescriptions; instead, invite audiences to provide input and participate
- Reflect on the efficacy of the message and produced outcomes, if any

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From the Field

- Your daughter's score on the PSAT, her current math course, and/or math teacher recommendation shows that she could excel in a **college-level computer science course**. Why should she consider a course in computing? Does she like to solve problems? Would she like a job where she can help people? Would she like a job that has been called "recession proof"? Would she be interested in a high paying job where she can work from home, be creative, and work as part of a team?



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Engagement by Design

- Design for information
 - (what do I want my audience to know)
- Design for communication
 - (what is an optimal way for communicating with my audience about this topic)
- Design for interaction
 - (how can I create opportunities for my audience to engage with others about this topic)

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Institutional Practices

structural and cultural



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Institutional Practices, High School CS

Structural

- Department
- Classes Offer
- Prerequisites/Sequencing
- Elective/Count toward Requirement
- Course Catalog
- Guidance Counselors
- Articulation/Coordination
- Opportunities for Cross-Curricular Engagement
- CS Integration
- Process for Student Supports
- Spaces

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Institutional Practices, High School CS

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From the Field

- Student course registration went online, numbers in CS dropped
- CS courses moved from math electives to College and Career Readiness credits
- Computer Science is its own "tab" on the course outline
- Changed name of "Exploring Computer Science with Python & Gaming" to "Exploring Computer Science"
- An introductory course using Python (easier than Java) and Gaming (Pygame) to teach programming
- NO student pre-requisite (any student can take it)
- If student earns 85 or higher from this course, they may then take Java: Computer Programming (even if they did not meet the Algebra I requirement)

Since we have made these changes (last 2 years), in addition to the previous recruitment techniques, enrollment has sky-rocketed and we have had to adjust accordingly

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Institutional Practices, High School CS

Structural

- Articulation/Coordination
- Opportunities for Cross-Curricular Engagement
- CS Integration



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From the Field

every 8th grader has an opportunity

Start with 8th graders so they each have an opportunity

- Frame computer science in an engaging way
 - Remember recruitment strategies and targeted communication
 - Posters, letters, and other efforts should include middle schoolers as well, especially 8th graders
- Recruit in broad strokes – include students who aren't already on track to take computer science classes
 - Include outreach in art, English, and other non-STEM classrooms



From the Field



Cross-Curricular Opportunities

- Math – how do computers store numbers? (Translate to binary, hex)
- Music – how can we code a repetitive song on paper? Isn't sheet music just code...?
- History – how can Napoleon use graph algorithms to optimize conquering Europe?
- Art – how can you "program" your partner to create a specific image?
- English – how can we code and decode messages? (symbolism, favorite quotes)
- Chemistry – how can we represent lab procedures in CS flowcharts or using loops?

From the Field

- In taking computer science concepts outside of the computer science classroom, our goals are to...
 - Expose students to computing concepts that would otherwise not encounter them
 - Generate interest in computer science in students that were previously uninterested
 - Cultivate a school culture that is aware and engaged in computer science education
- Ultimately, to recruit new students to take part in computer science classes, clubs, and activities



From the Field

Coordination/Alignment

Collaboration between middle and high school teachers to coordinate efforts

- Do high school teachers know what is being done in the middle school?
 - Prevent repeats
 - Design a continuous computer science experience
 - Build on existing strengths
 - Tie back to existing concepts
- Do middle school teachers know what is being done in high school?
 - Adequately prepare students
 - Introduce concepts covered in detail later on



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Institutional Practices, High School CS Guidance Counselors

- Counselors are powerful advocates – they can dispel myths about computing and relevant careers and examine scheduling practices and policies that may prevent students from enrolling in these courses; as such, they need to know the value and purpose of computer science

➤ Our district plans to add computer science in four high schools next year. This year, we started an after school app and programming club for girls to build awareness and readiness for those classes. I realize now that a specific effort targeting girls must be made to get more girls into classes



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Institutional Practices, High School CS

Structural

- Process for Student Supports
- Spaces

Students recruit students (with your help!)

- Provide a collaborative space that is inviting
- *Support Students helping students*

➤ Informational hub

- Emphasize community
- Space can be home for Student Clubs

CAYE



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Institutional Practices, High School CS

Social/Culture

- School/District Culture, Appreciation for CS
- Involvement of Guidance Counselors
- Support of Pedagogical Adjustments/Innovation
- Support of Cross-Curricular Engagement
- Understanding of Need for Student Supports
- Access/Time to Spaces

➤ Student CS Recruitment Plan

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From the Field

- Computer Club that does community service [with senior citizens and elementary students, and is predominately girls. The girls then take my courses, usually have around 40% girls]
- Promote courses in math classes (go into math classes both semesters)
- Meet with guidance counselors (in a group and one-on-one), provide a PPT with facts and statistics about the importance of CS in every field
- Reach out to 8th grade teachers and parents to promote *Intro to CS* course
- Send a Naviance email to all students (by grade) and their parents prior to online registration



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Outreach for engagement



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Outreach for Engagement, HS CS

- Events and clubs
- Summer CS class/experience
- Information exchange opportunities
- Collaboration with other departments
- Parent engagement and utilization
- Industry and higher education partnerships

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Outreach Opportunities

 BRINGING MIDDLE SCHOOLERS TO THE HIGH SCHOOL
 INCLUDING HIGH SCHOOL STUDENTS IN MIDDLE SCHOOL CLUBS
 GUEST PRESENTATIONS AND ACTIVITIES
 COMMUNITY OUTREACH EVENTS
 CLASSROOM VISITS

Outreach Opportunities

 PARENT ORIENTATION AND OUTREACH MEETINGS
 STUDENT ORIENTATION MEETINGS
 MEETING GUIDANCE COUNSELORS
 ATTENDING SCHEDULING MEETINGS

From the Field

Student clubs can show how CS has wide-application and can be fun and relevant

- Starting a club doesn't have to be too complicated you start out small
- Often space and a little pizza is enough
- Examples : Girls Who Code, All Star Code

Summer opps to provide additional entry points into CSE

- One-week app developer class
- Access to a maker-space





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From the Field

Parent and Family Engagement



- Recruit HS CS faculty/students to host at elementary/middle schools
- Reactions from Schools

"The event was a bigger success than I could have ever imagined. It was so exciting to see how engaged everyone was and how much fun families were having doing computer coding."

"Family Code Night was a blast, and your materials made it so easy to present. Thank you again for your hard work creating such a great program!"

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From the Field

Hackathons

- Individuals or teams work on coding projects
- Can have a theme (or not), if theme, e.g., going green, cybersecurity, consider inviting subject-area experts
- Reach out to local companies about sponsoring
- Can be programming, websites, Arduino, Raspberry Pi, anything tech related
- High and middle school versions work differently
- Additional Things to Consider: What to name your hackathon to appeal to your target audience, ensure you have basic supply requirements (power strips, projector, microphones, sound system), set up a functional seating arrangement – pods work best for teams, prepare handouts that you might need...




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From the Field

- **Debate** – how can we represent the steps to create a solid argument as a computer science flowchart?
- **Sports** – how can we apply code and computer science topics to navigate a blindfolded person through an obstacle course?
- **Chess** – how does artificial intelligence work? How do neural networks allow us to tell computers how to learn?
- **Art** – how can computers create and edit images? Do they count as "art"?
- **Photography** – how do computers represent images? How are photos coded and decoded in different formats?



Or pair up a computer science club with a non-computer science club to create an app that would be useful to them. Provides software-engineer experiences to CS student and CS experience to others.

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Instructional Practices

content pedagogical knowledge, integration



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Instructional Practices

- **Content Pedagogical Knowledge**
 - Collaborative Learning
 - Inclusive Classroom Practices
 - Culturally Relevant/Culturally Responsive
 - Project-Based
 - Meaningful Assessments
- **Cross-Curricular Engagement**
- **CSE Integration**
 - Supportive Institutional Culture
 - Institutional Resources, Structures, Processes

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What does it take to refocus our schools? What's in motion now...

- **State-wide plans & initiatives to address diversity**
 - CS course requirement?
 - CS satisfying core graduation requirement?
 - CS Professional Development?
- **Adoption of CS Standards (what we know...)**
 - PA has adopted CSTA K-12 CS Standards
 - NJ is working on developing CS Standards and is close to launch
 - There are already technology standards

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Discussion Question

Persistent inequities in the participation and performance of women and underrepresented minorities in computer science education are an ongoing challenge.

What are some strategies mentioned in this presentation that you can potentially adopt in your school or district?

How might you modify them to meet the particular needs of your community?

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Please reach out if you have any questions, are interested in potential collaborations, or otherwise!

Cindy Blitz
clblitz@gse.rutgers.edu
<https://cesp.rutgers.edu/>

Please also connect w me via social media
[@cindyblitzphd](#)
[linkedin.com/in/cindyblitz](https://www.linkedin.com/in/cindyblitz)

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