STUDENT VOICES from AP CSP

Addressing Challenges Related to the Binary System

About Our Student Partners

Over the 2016-2017 school year, **13 student research partners** enrolled in AP Computer Science Principles (CSP) at Wolcott School shared their successes and challenges in the course during every-other-week interviews with the Outlier research team.

Keep in mind that while our student partners were enrolled in an AP CSP course using the Code.org curriculum, the challenges they identified could occur in *any* high school CS course and for *any* student, not just those with diagnosed learning and attention disorders.

164 total student interviews

STUDENTS:
- were in 10th – 12th grade.
- had varying levels of prior experience with computer science.
- had at least one diagnosed learning or attention disorder.
  62% ADHD/Executive Function, 54% Writing, 46% Reading, 31% Math, 15% Language.

What We Heard: Common Challenges Related to the Binary System

Like the binary questions, I could not do for the life of me. Like the ones that are math, thinking in your head, trying to figure out how many zeros…or going from hex to binary.

I didn't understand how binary counting works until two days into that section on binary.

Some students had a hard time keeping track of the number of 0's when converting to and from binary, especially if they had difficulty with decimals.

Many students found binary to be a tricky concept to understand.

Some students had trouble seeing patterns of 1's and 0's because the numbers appeared to them to be mixed up.

The Binary System was a challenge for 7 of the 13 students in the AP CSP course.

How to Help

Addressing the Binary System Challenges in CS Classrooms

The following recommendations are informed by research-based practices for supporting students who learn differently, combined with the practical expertise of our team learning specialists and study findings.

Create a **reference sheet** that **shows how numbers are represented** in base-2 form in contrast to their base-10 form, **project it on a screen**, and walk students through specific examples.

Encourage students who are experiencing difficulty converting from decimal to binary to **check their work using an online unit converter**, like the one found at http://unitconversion.org/unit_converter/numbers.html.

Demonstrate for students how to convert from one unit of measure to another, and offer the use of calculators.

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