STUDENT VOICES from AP CSP

Addressing Challenges Related to Reading

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 Reading

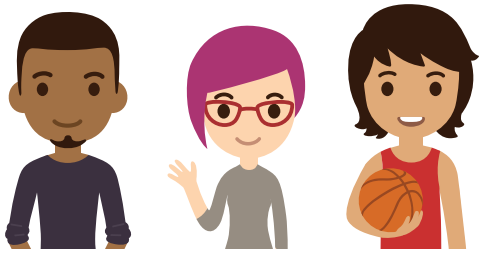
The instructions were not that clear so I had a lot of trouble figuring out what to do.

Students noted that the activity instructions were very long and often contained unfamiliar words.

Even after reading the instructions, many students were still not clear about what they were supposed to do.

Reading instructions is really hard ...because they're telling you a bunch at a time.

It was hard for students to understand exactly what the AP CSP exam and practice exam questions were asking.



Some students had trouble making sense of the information that they read online.

Reading was a challenge for 8 of the 13 students in the AP CSP course.

How to Help

Addressing **Reading** 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.

Read questions aloud as a group and **clarify new vocabulary** by rephrasing information and referring students to a running glossary (that you create for the class or that students create at the beginning of the school year).

Provide sufficient examples of work process and products to ensure students understand required work steps to move projects forward (e.g., share an exemplar, demonstrate additional examples, and suggest ways to break down work into smaller steps).

Prior to lessons that require online research and reading, **identify websites/ sources for students** to use based on clarity, simplicity, and readability. As necessary, guide students to sites that match their skill levels.

Suggested Citation: Outlier Research & Evaluation (2018). Student Voices Resource Pages: Common Challenges in AP CSP and How to Address Them (Reading). Chicago, IL: Outlier Research & Evaluation at UChicago STEM Education, University of Chicago. Retrieved from Outlier.uchicago.edu/accessCSP/#project-resources/.

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STUDENT VOICES from AP CSP

Addressing Challenges Related to Collaboration

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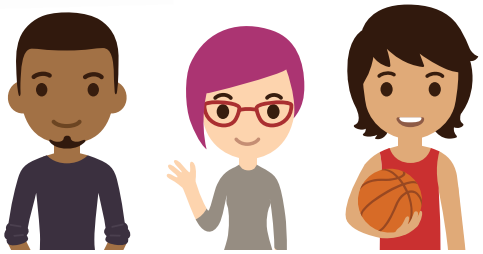
What We Heard: Common Challenges Related to Collaboration

I got extremely frustrated with them cause they didn't know what they were doing…Basically there was a ton of work on my half… And then the fact that I wasn't doing it fast, they thought they did everything right even thought I blatantly told them that you messed up. And they were blaming me.

People started getting frustrated. There were arguments and it wasn't very productive.

Some students felt like they could not move on as quickly as they would have liked because their partner didn't understand the work as well.

Sometimes group members argued when they couldn't agree on how to solve a problem.



At times, some students preferred to work alone because they felt like they did more work than their partner.

Collaboration was a challenge for 6 of the 13 students in the AP CSP course.

How to Help

Addressing **Collaboration** 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.

Intentionally place students in partners or groups that will be supportive of learning differences to minimize difficulties that could arise because of social skills or other factors.

Explicitly state that students will work or problem-solve together (not just work in parallel). **Review guidelines** and **model strategies** for students on how to work together (e.g., only one person talks at a time; everyone accepts feedback; listen actively; people can share differences of opinion). Guidelines can be posted in the classroom as a visual reference.

When appropriate, **assign group roles** for students (e.g., such as being a recorder) to provide some accountability and help students stay focused on the assigned task.

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STUDENT VOICES from AP CSP

Addressing Challenges Related to the Binary System

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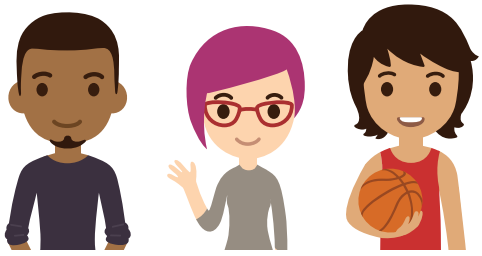
What We Heard: Common Challenges Related to the Binary System

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.

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



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.

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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STUDENT VOICES from AP CSP

Addressing Challenges Related to Organization and Planning

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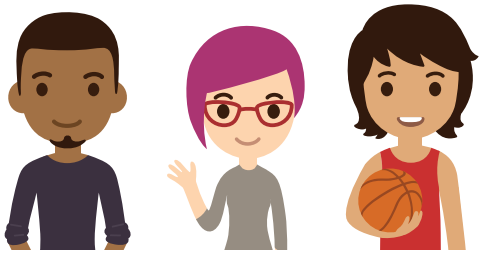
What We Heard: Common Challenges Related to Organization and Planning

My issue is with organization. Not only that, but I'm having trouble with something and it's like, instead of do it, I literally just kind of put it to the side for now. It's bad, but I do it.

Students were often not sure where to start on a large project, or how to actually begin doing the work.

Earlier in the semester I forgot to turn in some stuff. So my grade sunk like a rock for a bit…I have this habit of forgetting to just turn in things.

It was hard for some students to prioritize and manage their work time.



Some students had trouble keeping their class work organized.

Organization and Planning was a challenge for 6 of the 13 students in the AP CSP course.

How to Help

Addressing **Organization and Planning** 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.

Engage in frequent check-ins with students to provide time for **direct and specific feedback** about work, and to provide opportunities for students to identify sections where they might be getting stuck.

Supply tools (e.g., **graphic organizers, project templates, and task checklists**) to assist students with organizing their thoughts, and breaking down projects into smaller tasks.

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Addressing Challenges Related to Programming

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What We Heard: Common Challenges Related to Programming

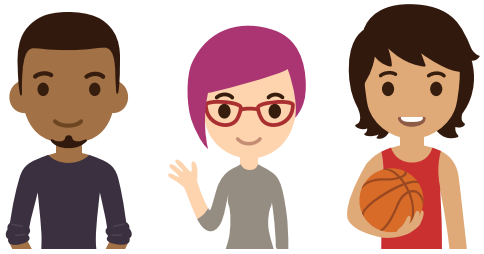
I messed up my parentheses…I didn't do the parentheses for the loop, so I kept getting really weird, wonky outputs and I wasn't sure what was happening.

Some students made programming mistakes like mixing up symbols and putting pieces of code in the wrong order.

When writing a program, sometimes students needed to use math concepts and operations that they didn't understand.

I think I wrote a code that was 30-something lines and there was an error at one point and I couldn't tell where it was…It took me 2 days to figure out.

For many students, it took a long time to find errors or figure out what was missing when their programs didn't run.



Students were not sure what some commands did, or when they should be used.

Programming was a challenge for 8 of the 13 students in the AP CSP course.

How to Help

Addressing **Programming** 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.

Circulate and assist students in debugging for errors by **modeling** necessary steps and providing example approaches (which may also be posted on the wall for continued reference).

Project key mathematical terms and operators on a presentation slide or white board so they are accessible as students work.

Assist students in creating an electronic document (Word, Google) to **record variables used in their programs**. Students can refer to this document to: a) compare variables side-by-side to identify errors when debugging, and b) copy and paste the variables into the program.

Create a **reference sheet listing new code** with a short descriptor of the command and the type of variable that should be entered in the command. Encourage students to keep this reference handy while working.

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Addressing Challenges Related to Focus, Attention, and Pacing

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What We Heard: Common Challenges Related to Focus, Attention, and Pacing

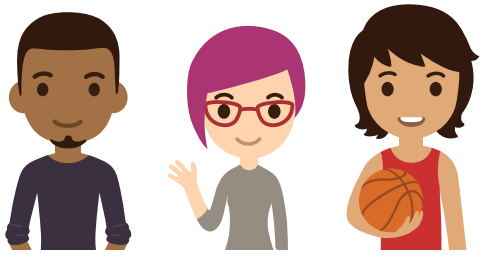
With my ADHD, it's harder for me to sit there, focus, and try to follow along unless I'm actually doing something…then I'll be on task.

Students needed more time to reflect on, understand, and process new material.

Some students were easily distracted by the other students in the class.

We don't get a lot of time to do stuff. We have to do things quickly, which is frustrating… I do things slower. Everyone else is done and I need them to wait.

Some students had trouble staying focused when studying for the AP CSP exam.



It was hard for some students to sustain their attention to complete long-term projects and independent work.

Focus, Attention and Pacing was a challenge for 10 of the 13 students in the AP CSP course.

How to Help

Addressing **Focus, Attention, and Pacing** 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.

Provide students with **additional time** for assignments, projects, and tests, where needed. In particular, provide more time for introducing new vocabulary and concepts than what is suggested in the instructional materials.

Circulate and provide support to students who may be having significant difficulty initiating or making progress on **independent tasks or projects**. For example, some students may need specific guidance around selecting a project topic, identifying necessary work steps, and sustaining an appropriate pace to complete the work on schedule.

To help students focus during **exam prep**, use the CSP reference exam sheet and add an additional column to show the code they used in class and the pseudo-code that will appear on the exam, side-by-side. Use two different colors to differentiate the one from the other. Build the sheet as a foldable.

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Addressing Challenges Related to Written Expression

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What We Heard: Common Challenges Related to Written Expression

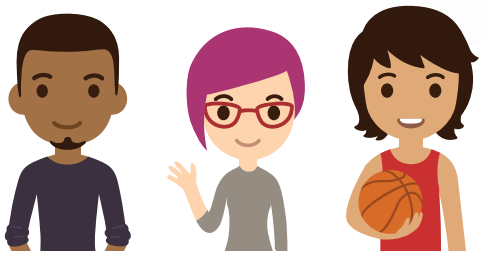
I have to write 100 words on 2 or 3 things and 250 words on 2 things, maybe 3 things. It's a lot of writing and I have to make it like I'm saying different things. It's not enjoyable.

Some students had a hard time meeting word count requirements – they either wrote too much or too little.

Getting the write-up done [for the Create Performance Task]. That was the toughest part…I'm very hands on and creative so I can do the app and what not. And when it comes to write up and all the words on the page, it's like black and white. Really tough to focus and just sit and get it done.

Sometimes students were unsure how to structure and organize their ideas before writing.

A few students didn't really like writing, so they tended to avoid it.



Some students knew what they wanted to say, but didn't know how to put their thoughts into words or write their ideas down quickly enough.

Written Expression was a challenge for 8 of the 13 students in the AP CSP course.

How to Help

Addressing **Written Expression** 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.

Provide **sentence starter templates** (verbally, or in writing) to help students formulate their thoughts and express them in writing.

Offer the use of **text-to-speech software** to let students listen to and edit their written responses.

Encourage students to use **graphic organizers** (that you create, or find online) as part of planning for writing, to help them structure and organize their ideas.

Offer students the use of **dictation software** to add their thoughts and ideas to electronic documents (e.g., Word documents) as the first step before working to organize those thoughts into a cohesive written text.

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