

LEARNING FROM STUDENTS IN EXPLORING COMPUTER SCIENCE:

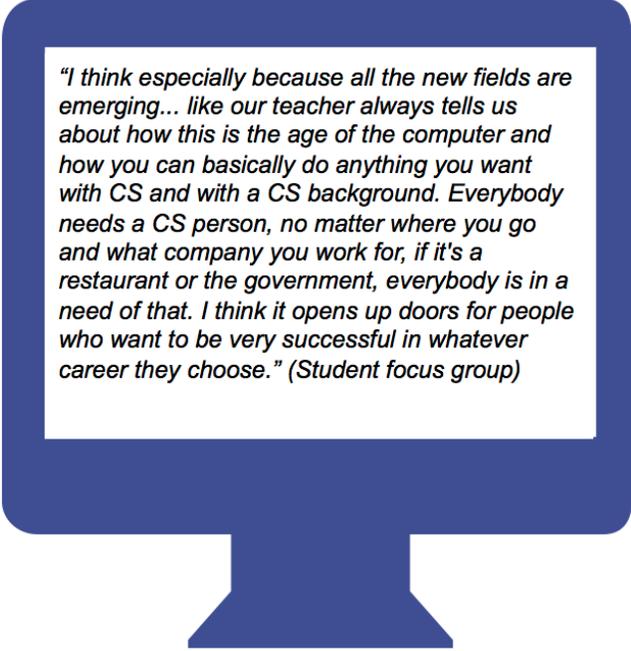
While there is much talk among adults involved in computer science (CS) education about why CS knowledge is important, less is typically heard on the subject from students themselves. Information from students about what aspects of an introductory CS class they think are directly relevant to them, and whether they think there is value in CS for other students, can help inform our collective efforts to expand quality opportunities in CS for all students and serve as a powerful advocacy tool for student recruitment into CS. Who better to convince district and school leaders without CS offerings that they have value to students, or to encourage other students to enroll in CS courses at their school, then peers who have already taken introductory CS courses?

Here, we highlight student responses to several questionnaire and focus group questions that help us begin to understand what students enjoy and value about learning about CS, for themselves and for other students. These questions were asked as parts of student-level data collection in our NSF-funded BASICS study, which focused more broadly measuring implementation of the introductory CS curriculum Exploring Computer Science (ECS) and the supports and barriers to that implementation. In the Spring of 2015, the BASICS student questionnaire was administered to 957 students in five sites: Chicago, IL; Washington, D.C.; Los Angeles, CA; New York City, NY; and Broward County, FL. Student focus group data was simultaneously collected with students (N=46) at eight of these schools in Chicago.

One item on the questionnaire asked students to respond to the question, *“Would you recommend that another student take this computer science course?”* and then to tell us in their own words why they would or would not recommend the course. In the focus groups, we asked a similar question to provide an opportunity for students to explain their thoughts about whether other students should or should not take introductory CS in greater depth. Our questionnaire findings are described below, along with related findings from two other questionnaire items and student focus group quotes, to provide a rounded and rich picture of student perceptions.

WHAT WE FOUND:

Of the students who responded to the *“Would you recommend....”* questionnaire item (N=933), 84% (N=784) said *“Yes,”* they would recommend the course to other students. We focus here on these responses to explore the reasons behind students’ positive perceptions about CS generally and the introductory course in particular. A grounded theory approach was used for coding the qualitative responses by two researchers. In their responses, some students provided more than one reason for recommending the course (for example, *“Because it offers insight into a rapidly developing job field, also it’s interesting”*); as researchers coded each reason students gave, the total percentages add up to more than 100.

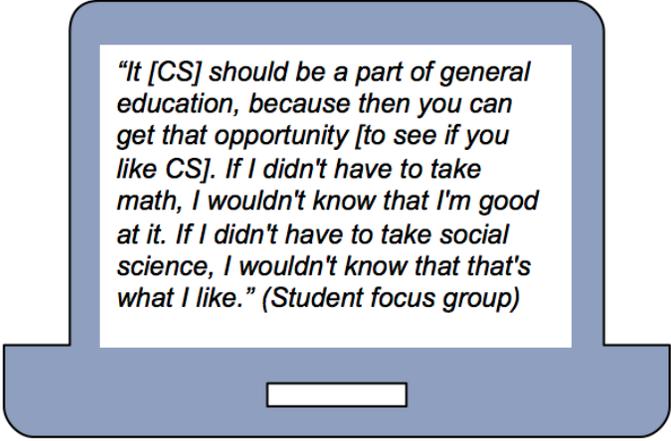


"I think especially because all the new fields are emerging... like our teacher always tells us about how this is the age of the computer and how you can basically do anything you want with CS and with a CS background. Everybody needs a CS person, no matter where you go and what company you work for, if it's a restaurant or the government, everybody is in a need of that. I think it opens up doors for people who want to be very successful in whatever career they choose." (Student focus group)

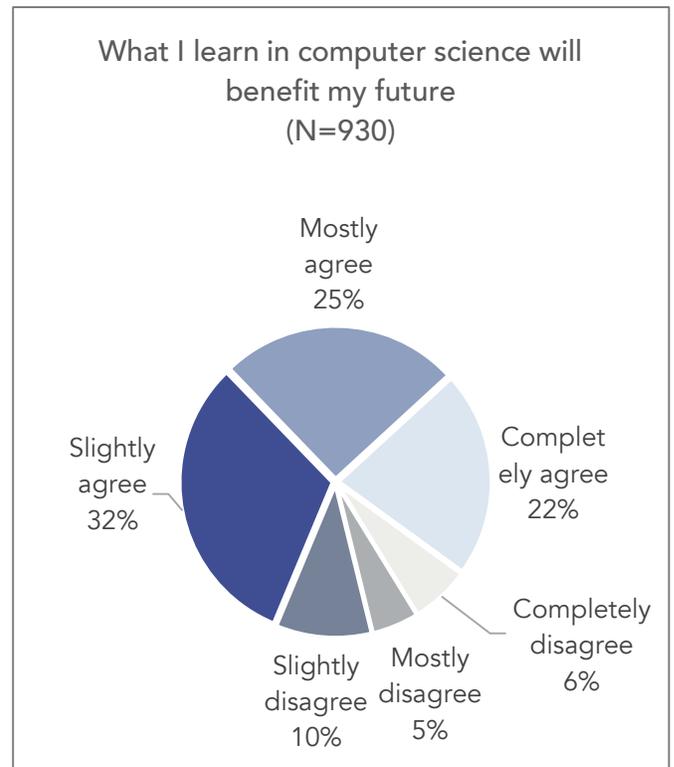
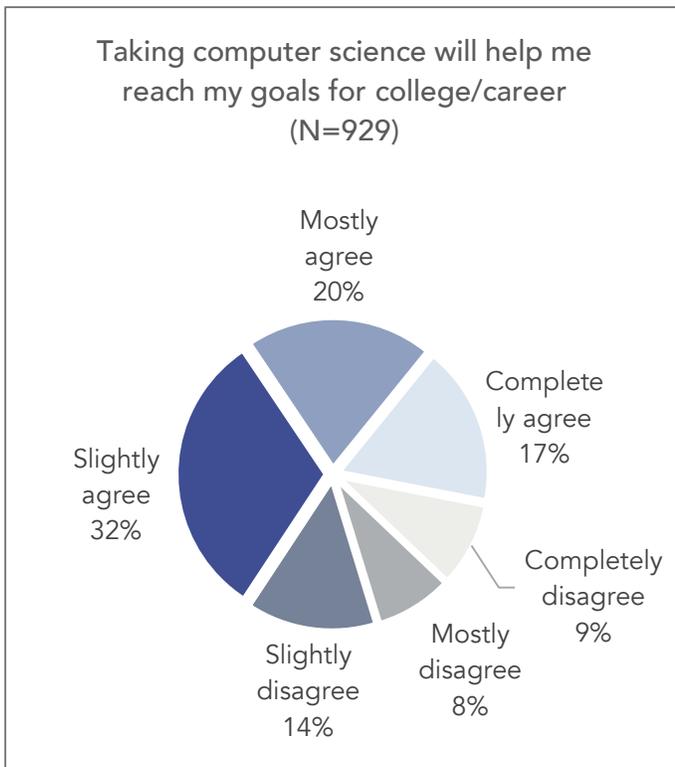
The most commonly cited reason for recommending the course, identified by just over half (53%) of the students, involved the utility and benefits of knowing CS/computing. Some students within this group spoke generally about the utility and benefits of CS knowledge (13% of all students), and gave reasons such as *"it's relevant to the times," "it's helpful,"* and *"it's a good thing to have education in computer science."* Other students cited more specific skills and knowledge gained in the class that are useful (14% of all students), saying, for example, *"the course teaches you the basics, and it is important to be able to help yourself when it comes to computers," "it gives you a lot of helpful tools for computer navigation, and software applicability,"* and *"it's beneficial problem solving skills, and analysis capability."*

The other half of students who identified the utility and benefits of knowing CS/computing for education (26% of all students) gave reasons that included more specific identification of benefits CS could hold for their future—acknowledging benefits both for CS-related education and career paths and for non-CS specific endeavors. These students provided responses that included, *"[i]t's a good starting foundation for future computer classes," "I would recommend this course to another student because today jobs in computer sciences are more and more in demand," "[b]ecause it teaches you many valuable skills that will help you in the future, even if you don't choose a job related to computer science,"* and *"this course will definitely help any student in the future."*

This focus on CS for its potential benefits to students and their peers in the future was also reflected in students' responses to two questionnaire items that directly asked them to answer questions about the relevance of CS to their own future. Sixty-nine percent of students agreed with the statement, *"Taking computer science will help me reach my goals for college/career,"* with 37% of students reporting that they *mostly or completely agreed*. Further, a full 79% of students agreed with the statement, *"What I learn in computer science will benefit my future,"* with 47% *mostly or completely agreeing*. The finding that in both these and the open response questionnaire items students consistently identified future relevance of CS for themselves and for other students provides important insight into students' perception of the value of learning CS.

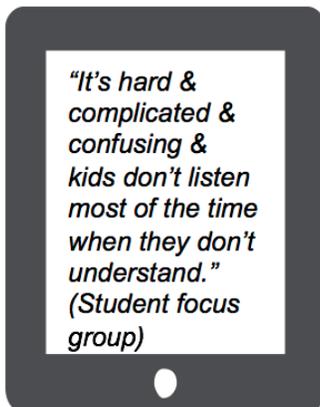


"It [CS] should be a part of general education, because then you can get that opportunity [to see if you like CS]. If I didn't have to take math, I wouldn't know that I'm good at it. If I didn't have to take social science, I wouldn't know that that's what I like." (Student focus group)



Another group of responses to the question of why students would recommend the course (39%) focused in very general ways on the aspects of the class that they enjoyed, like the course being fun, interesting, or “good” (e.g., “it’s fun to learn,” “it is fun and interesting,” and “it’s a good class”).

Other less-frequently cited reasons for recommending the course included that the class was easy (4%), that taking the course could help students discover whether they do or do not like CS (3%), that everyone should try it/CS should be for “all” students (1%), and that the teacher was good (1%).



While the majority of responses indicated that students believe other students should take CS, some students were less positive (16% of all students), saying “No,” they would not recommend introductory CS to another student. Reasons given for not recommending the course included that students felt it to be boring/not interesting, a waste of time/irrelevant to their own career plans, difficult (“It is too hard & complicated & confusing & kids don’t listen most of the time when they don’t understand”) or alternately lacking in depth of content, or that they could not recommend the course to others “[b]ecause it might not be essential to for their career goals”.

WHY STUDENT VOICES ARE IMPORTANT:

Together, these qualitative and quantitative findings provide insight into the student experience in introductory computer science. Our collective CS education efforts are intended to benefit students, yet oftentimes in education efforts, their voices are overlooked. As Fielding (2001) and Mansfield (2014) point

out, researchers and education leaders who speak about or for students instead of drawing directly from authentic student voices end up limiting the impact of their well-intentioned advocacy efforts. Notwithstanding emerging work, there are few research findings that specifically highlight K-12 CS student voices about their experiences in high school CS and their perceptions about the direct role CS will play in their own and in other students' lives. Yet students who are already engaging in CS learning opportunities are poised to contribute to our CS educational expansion efforts through the power of their words. Their feelings, represented in these study findings, suggest that students who have taken an introductory CS course, like ECS, ultimately leave the class with a positive perception of the value of learning CS for not only their themselves and their own futures but also the future of their peers, but that there is likely more we can do to make those connections even more clear for more students.

REFERENCES CITED:

Fielding, M. (2001) Students as radical agents of change. *Journal of Educational Change*, 2: 123-141.

Mansfield, K. (2014). How listening to student voices informs and strengthens social justice research and practice. *Educational Administration Quarterly* Vol. 50(3): 392-430

ABOUT THE BASICS STUDY:

The Barriers and Supports to Implementing Computer Science (BASICS) study is a three-year exploratory research project funded by the National Science Foundation (#1339256) as part of the CS10K program – an ambitious effort to have 10,000 well-trained computer science (CS) teachers in 10,000 schools. The BASICS study seeks to contribute to this effort in part by informing policy, school, and stakeholder leaders about the supports and barriers to wide-scale introductory CS education in high schools and strategies for addressing them. It is important to note that BASICS is not, in any way, an evaluation of ECS. Rather, the BASICS study focused on the ECS curriculum as an example because it is widely used to teach introductory high school CS.

Outlier Research & Evaluation (August 2017). Saying Yes to Computer Science: Why Students Tell their Peers to Take Introductory Computer Science. Chicago, IL; Outlier Research & Evaluation at UChicago STEM Education | University of Chicago. Retrieved from <http://outlier.uchicago.edu/basics/findings/HSStudentsRecommendCS/>

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