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The Exploring Computer Science (ECS) high school curriculum is designed to foster deep engagement through equitable inquiry around computer science concepts. We have shown that students find ECS courses personally relevant, are increasing their expectancies of success and perceived value for the field of computer science, and are more likely to take another computing course.

Exploring Computer Science (ECS) is a curriculum and professional development program that was developed at the University of California, Los Angeles (UCLA), with the goals of contributing to broadened participation of women and minorities and increased equity in the field of computer science.[1] Specifically, the ECS curriculum seeks to accomplish the goal of broadening participation by introducing the field of computer science and computational practices in a way that makes the field relevant, engaging, and stimulating for a diverse population of students. The ECS curriculum is composed of activities that are designed to engage students in computer science inquiry around meaningful problems; the ECS professional development program is designed to prepare teachers to implement these inquiry-based activities while also guiding teachers in building a classroom culture that's culturally relevant and inclusive of all students. Prior studies have successfully documented the impact of this professional development on the quality of ECS implementation.[2,3]

With continued support from the US National Science Foundation (NSF), a variety of university- and community-based organizations are adopting the ECS program and rapidly expanding its reach to cities across the US (http://www.exploringcs.org/about/ecs-now). The NSF-funded Taste of Computing project in Chicago was one of the first to implement and sustain the ECS curriculum and professional development program outside of Los Angeles, starting with a pilot in the 2011–2012 school year.[4] In the first two full years of implementation (2012–2013 and 2013–2014), 26 Chicago Public Schools (CPS) high schools enrolled more than 4,600 students in ECS courses. A substantial number of Taste of Computing students were female (45 percent), African American (42 percent), and Hispanic (42 percent). Our previous research in Chicago found that students perceived the ECS course to be personally relevant and engaging, and, as a consequence, increased their awareness of the field of computer science and its diversity. This awareness was correlated with increased interest in taking another computer science course in high school.[5] Although increasing enrollment in further computer science isn't a central goal for ECS developers, it can be a valuable consequence of providing students with meaningful experiences in computer science.

In this research, we seek to extend our prior work to investigate the extent to which students' perceptions of the personal relevance of the ECS course predicts the likelihood that they'll take another computer science course in high school. Specifically, our research is guided by the following research question: Do students' perceptions of the personal relevance of their ECS course influence the probability that they'll take additional computer science coursework in high school?

At the time of the study, CPS policy treated computer science as an elective course. Subsequent to completing ECS, CPS students could decide whether to pursue additional coursework in computer science. Depending on the school, options included courses such as game design, web development, and database programming, in addition to advanced placement (AP) computer science. Our hypothesis is that the extent to which students perceive ECS as personally relevant to their lives will influence their decision making about future coursework. The availability of a variety of computer science courses at the CPS high schools in this study allows us to use students' actual decisions about taking another computer science course as the outcome measure of interest. Given the significant number of women and minority students who have participated in Taste of Computing, the conclusions from this research will be directly applicable to informing the efforts to use ECS as a mean to broaden participation in computer science.

The Key Components of the ECS Curriculum

Key to the design of the ECS curriculum is what Nasir and Hand[6] refer to as deep engagement within a community of practice. When computer science is not taught for deep engagement but rather as an abstract academic subject, it privileges access to computer science to mostly Caucasian, male students.[7] To play an integral role in such classrooms, students must master abstract programming for programming's sake. Typically, computer science courses at both high school and college levels have been taught in this abstract way.[8] For non-Caucasian students in low-income neighborhoods, computer instruction has tended to focus on computer applications and has lacked opportunities for engaging in collaborative inquiry.[7,9]

The ECS curriculum is designed to engender deep engagement with important computer science concepts by mimicking important features of communities in which youths participate outside the classroom. General technology use outside of school by youths of all races and genders tends to revolve around making social connections and working on practical problems.[10] Reorienting computer science instruction to be culturally relevant and focused on problem-solving experiences that are meaningful to students has the potential to increase access to computer science content, provide students with integral roles, and create opportunities for students to express themselves.[11,12] At the college level, computer scientists at Carnegie Mellon made progress at increasing the representation of women in their computer science program by making such changes to the nature of instruction in their introductory courses. Students develop technical fluency through solving problems of interest.[8]

Likewise, the high school ECS curriculum focuses on making computer science concepts accessible through opportunities to use them in meaningful ways. The curriculum supports deep engagement through three strands (equity, inquiry, and CS content),[1] with equity being the foundational strand. Inclusiveness is supported by focusing on ideas that are meaningful to students, and activities in the curriculum provide space for teachers to incorporate students' background and culture. In addition, many activities focus on real-life issues in the community—for example, students can make games that communicate messages about healthy eating or about the plight of undocumented students.[1]

Resting on equity are inquiry-based activities in which students are "expected and encouraged to help define the initial conditions of problems, utilize their prior knowledge, work collaboratively, make claims using their own words, and develop multiple representations of particular solutions."[1] By engaging students in equitable inquiry through the first two strands, students gain access to the domain content of computer science, the third strand. Thus, the logic model for this research is that if computer science teachers successfully implement meaningful experiences for students, then students will experience the course as personally relevant.

Translating ECS Curriculum Components into Classroom Teaching

Curriculum materials and activities represent one component of the ECS program. Given the significant shift in the nature of computer science teaching required for successful implementation of ECS, teachers need significant professional development to successfully adapt to the ECS model of teaching.[3]

In Chicago's Taste of Computing project, about half of the participating teachers (52 percent) had a background in computer science; roughly one-third had a background in business (26 percent) or in a non-computer science area of STEM (8 percent). The remaining 14 percent had a background in some other subject area. The teachers of traditional high school computer science courses needed to shift from foregrounding the content of computer science to foregrounding the application of computer science concepts. The non-computer science teachers needed to develop an understanding of computer science concepts in addition to an understanding of the pedagogy. Given the prevalence of low expectations in many urban schools regardless of the subject area,[13] most teachers also needed to confront their own—often hidden—biases about who can be successful in computer science.

The ECS professional development program is intentionally designed to prepare teachers to implement the inquiry-based activities while also guiding them to build a classroom culture that's inclusive of all students.[3] Professional development begins with a weeklong summer workshop prior to implementing ECS. There are five key components of the ECS professional development model, the first being that teachers engage in the process of collaborative inquiry in small groups in the same way that students will engage in inquiry. The second key component is that, throughout the first week, teachers participate in inquiry specifically through a teacher-learner-observer model. Each small group is assigned a lesson in which the group co-plans and teaches the lesson to the rest of the participants, who then complete the lesson as learners. After the lesson, all the participants engage in reflective discussion about the experience from the point of view of the three ECS strands (equity, inquiry, and CS content). These first two components of ECS professional development are consistent with what Desimone and Garet[14] call active learning in professional development. Their review of professional development found that active learning was an important component of professional development as it significantly influenced changes in teacher practices.

The third key component of ECS professional development is explicit discussion and reflection on equitable practices. During the workshop, the teachers read sections of *Stuck in the Shallow End*,[7] which provides rich case study descriptions of the roots of inequity in computer science. The fourth and fifth key components of ECS professional development are meant to sustain teachers over long time spans, which is another key dimension of effective professional development.[14] The fourth component is ongoing professional development during the school year and a second weeklong workshop the summer after their first year of implementation. The fifth component of ECS professional development is the development of a professional learning community. It begins in the summer workshop through the formation of small groups that engage in collaborative inquiry. It's also built up through the trust that teachers develop as they engage in tough, open discussions about equity as well as through open, honest feedback on lesson design and implementation during the workshops.

The developers of the ECS curriculum have begun to characterize the nature of classroom teaching that has emerged from the combined ECS curriculum and professional development program in Los Angeles, highlighting the prevalence of a variety of classroom practices that are hallmarks of the ECS approach.[15] Teachers were able to reliably support equity and the development of computer science concepts by creating inquiry-based project experiences. McTighe and O'Connor[16] indicate that these kinds of project experiences provide students with performance goals that are personally meaningful.

Under the inquiry strand, there was greater variability in classroom practices, especially among teachers in their first year of teaching ECS. Teachers were commonly able to encourage exploration in one-on-one or in small groups. However, they were less likely to be observed "scaffolding learning by making explicit connections between lessons or units," "using journal writing for metacognitive reflection," or "differentiating instruction." In addition, there was significant variability in the nature of questions that teachers used to facilitate student thinking. The most frequent type of question was related to checking for student understanding, which is at the lowest level of Bloom's taxonomy;[17] the least frequent was evaluating, which is the highest level.

This study wasn't able to undertake systematic classroom observations of teaching during the Taste of Computing project. However, anecdotal observations of teachers indicate that the implementation of ECS in Chicago is consistent with the kinds of observations made in Los Angeles.

Inspiring Students to Pursue Future Coursework

For this research, we seek to build on our prior work[5] by using the expectancy-value-cost model[18] as a mediator for predicting the probability that students will take another computer science course after ECS. The expectancy-value-cost model is an extension of the expectancy-value model, which is based on decades of research conducted by Eccles[19] on students' choices of majors and careers. These choices are dependent on how much value students put in the field as well as their expectation that they'll be successful. Eccles' research has shown that over time, students' expectations for success are based on successful experiences with relevant school subjects. The value that students place on a particular field is influenced by their enjoyment of experiences in the field, perceptions of whether the field will meet personal goals, and the extent that the field is valued by family, friends, and educators.

Of the corpus of research on the link between expectancy-value and future aspirations, two studies in particular are directly related to this research. The first looks at pedagogical approaches that support growth in expectancy-value.[20] The study took place at three middle schools in Greece where students were just finishing their first year of instruction in information technology. The students were surveyed on their expectancy-value as it relates to information technology, as well as the extent to which their teachers used practices that made meaningful connections to the real world through active learning. These practices are similar to the equity and inquiry strands of ECS. The results indicate that exposure to meaningful experiences significantly predicted growth in the value dimension but not the expectancy dimension, providing support for the hypothesis that experiences in ECS could increase the value students place on computer science by engaging them in meaningful tasks.

The second study of interest[21] examined computer science course selection at five middle schools in Germany. Students were free to select computer science as one of their elective choices. The expectancy-value model helped predict course selection among boys and girls; those with high expectancy-value were equally likely to select a computer science course. However, expectancy-value was significantly different for girls than boys, which explained a significant amount of the variation in course selection between boys and girls (boys were higher in both expectancy and value). This research provides support for the hypothesis that expectancy-value is an important mediator of course selection and highlights the need to provide girls and minorities with meaningful experiences that can equitably influence expectancy-value.

Methods

This study took place in Chicago during the 2012–2013 and 2013–2014 school years, which were the first and second years of the implementation of the Taste of Computing's ECS professional development program in 26 schools. Twelve teachers at seven schools agreed to participate in the study by administering an end-of-course student survey. Overall, the study sample of teachers had fewer teachers that identified as African American, more teachers that identified as Caucasian or Asian, more males, and more teachers with computer science background than in Taste of Computing as a whole. The level of teaching experience and experience in the tech industry was similar. It's important to bear in mind that at the beginning of Taste of Computing in September 2012, Chicago teachers went on a month-long strike for the first time in 25 years.[22] Anecdotally, we saw evidence of the tension surrounding the strike as several teachers expressed apprehension about outsiders collecting data since they were new to ECS or in schools that were challenging due to the overall low academic performance of the students in the school.

Population

At the time of the study, ECS was an elective course for students; students in Chicago typically opted in to take computer science. The 12 participating teachers had 952 students who completed the ECS course, and all were invited to participate in the student surveys. We included 418 students (44 percent) in the analysis who agreed to be in the study, completed the end-of-year survey, and whose parents consented for their participation. Table 1 shows the demographic information for CPS and Taste of Computing; the demographics for the full population of Taste of Computing students are similar to the demographics of CPS as a whole. Table 1 also shows that the demographics for the seven participating sample schools and the sample of students in ECS courses at these schools were similar. The study sample reflects the tendency of teachers from schools with less challenging teaching environments to agree to participate in the study.

Table 1. Demographic information about Taste of Computing study participants relative to sample schools and Chicago public schools as a whole

Demographic information	Sample	Sample schools	Taste of Computing	Chicago public schools
% Hispanic	48%	44%	42%	43%
% African American	12%	14%	42%	43%
% Caucasian	23%	25%	9%	8%
% Asian	13%	13%	4%	3%
% Female	47%	-	45%	-
% Free or reduced lunch	65%	64%	85%	85%
% Special education	5%	7%	14%	15%
% English language learner	4%	4%	5%	6%
Attendance rate	95%	93%	89%	87%
EXPLORE Math score	19.5	19.7	15.8	16.0

Instruments

In the last month of the school year, the participating teachers administered an end-of-course survey that students completed online via SurveyMonkey. The survey took approximately 15 minutes of class time to complete. If students were absent on the day the survey was administered, teachers made an attempt to administer it when they returned. Table 2 shows the survey scales that we used for this study along with the wording of the questions that comprised each scale.

Table 2. End-of-course student survey questions.

Survey scales	High value	Questions
Change in interest	68% increase	How has your interest in taking another computer science course changed as a result of this computer science course?
Personal relevance of ECS course	71% high relevance	This computer science class is helping me toward my goals.
		This computer science class gives me skills that help me in other classes.
Computer science expectancy	53% high expectancy	When a question is left unanswered in this computer science class, I continue to think about it afterward.
		Once I start working on a computer science problem or assignment, I find it hard to stop.

Computer science value	83% high value	I will need computer science skills for my future work/career.
		I will use computer science in many ways throughout my life.
Computer science cost	81% low cost	The challenge of computer science does NOT appeal to me.
		Taking computer science classes is a waste of time.

We asked students the extent to which their course experience changed their interest in taking another computer science class in high school by using a standard five-point Likert scale, where the answer options ranged from decreased significantly to increased significantly. We included a middle option to indicate that their interest stayed the same. For the remaining attitudinal questions, response options ranged from strongly disagree to strongly agree with a neutral option in the middle. We asked students about their perceptions of the personal relevance of the ECS course (alpha reliability 0.67), expectancy of success in the field of computer science (alpha reliability 0.73), perceived value of the field of computer science (alpha reliability 0.84), and perceived costs related to pursuing computer science (alpha reliability 0.63).

At the end of the survey, students were asked two open-ended questions about what they liked and did not like about the course: What did you like the most about this computer science course? What changes would you suggest for the next time this computer science course is taught?

CPS District Data

Through a data-sharing agreement with CPS, we were provided data about students in the sample. CPS provided students' 9th grade standardized math performance on the EXPLORE exam, cumulative GPA for the year they completed ECS, course grade, and demographic information about race, gender, and designation as special education, English language learner, and/or free or reduced lunch participation. CPS also provided information about any subsequent computer science courses students completed in the years after completing ECS. All seven of the participating schools provided other computer science courses for students to take after completing ECS, which will be the dependent variable for the study to provide evidence on whether students' experiences in ECS predict future course taking.

Results

Table 2 shows a descriptive summary of student responses to the end-of-course survey. Scale averages above three are labeled as high or increase. At the end of the course, almost three-fourths of the students (71 percent) rated the personal relevance of their ECS course experience as high. More than three-fourths of the students (83 percent) indicated that they highly valued the field of computer science. Over half of the students (53 percent) had a high expectancy of success in computer science. More than three-fourths (81 percent) felt that there were low costs to participation in computer science.

When asked about how ECS changed their interest in taking another computer science course in high school, over two-thirds of the students increased their interest (68 percent) and about one-tenth decreased their interest (12 percent). Of the 418 students in the sample, 309 went on to take another computer science course in subsequent years at CPS (74 percent).

As a first step in our analysis, we examined the extent to which students' perceptions of the personal relevance of the ECS course influenced their expectancy-value-cost. We conducted three stepwise regressions using personal relevance of ECS to predict each of the dimensions of expectancy-value-cost, controlling for prior achievement and demographic factors. The personal relevance of the ECS course positively predicted all three factors by increasing expectancy ($F(1,407) = 174.7$; $p < 0.001$; $R^2 = 30\%$; $\beta = 0.55$) and value ($F(2,406) = 174.9$; $p < 0.001$; $R^2 = 46\%$; $\beta = 0.67$), and reducing cost ($F(3,405) = 24.5$; $p < 0.001$; $R^2 = 15\%$; $\beta = -0.30$).

Next, we examined the extent to which expectancy-value-cost in turn predicts student change in their perceived desire to take another high school computer science course. We conducted a stepwise regression using expectancy-value-cost to predict change in their perceived desire to take another high school computer science course, controlling for the personal relevance of the ECS course, prior achievement, and demographic factors. The regression model was statistically significant ($F(6,402) = 56.9$; $p < 0.001$; $R^2 = 45\%$). Expectancy ($\beta = 0.15$), value ($\beta = 0.26$), and cost ($\beta = -0.28$) were all statistically significant predictors of students' change in interest in taking another high school computer science course.

Finally, we examined the extent to which actually taking another computer science course was predicted by students' perceived changes in interest in taking another high school computer science course, expectancy-value-cost, personal relevance of the ECS course, prior achievement, and demographic factors. Because the variable of whether students took another computer science course is dichotomous, we used logistic regression. The distributions of both GPA and ECS course grade were skewed. In addition, the distribution of EXPLORE math scores was spread out such that there were relatively small numbers of students in any given score category. For all three of these achievement variables, we rescaled them into quartile ranges.

Table 3 shows the results of the logistical regressions. As a baseline model, we first examined whether any demographic or prior achievement variables predicted the probability that students would take another computer science course. We used a stepwise regression in which all the variables were entered into the regression. The variable that provides the most information is added to the equation, and the regression is run again to add the variable that provides the next most amount of information until the equation includes only variables that are statistically significant. The results of the baseline model are shown as Model 1 in Table 3; variables with a blank cell aren't included in this model.

(Variables that were initially included in the model but that weren't included through the stepwise process are indicated with NS). For variables that were statistically significant, the logit value is provided in the cell, and significance levels are indicated as 0.05 (*), 0.01 (**), or 0.001 (***). A logit is the log of the odds that a student will take another computer science course. Taking the exponential of the logit gives the odds, or the probability of taking the course divided by the probability of not taking it. The predicted probability can be calculated by dividing the odds by 1 plus the odds. Positive numbers indicate that the variable increases the probability that students will take another course, and negative numbers indicate that the variable decreases the probability that students will take another course.

Table 3. Results of logistic regression predicting whether students took another computer science course.*

Independent variables	**Probability of taking another computer science course**	
	Model 1	Model 2
Constant	**-1.13*** **	**-0.82***
Achievement		
EXPLORE math	**0.53*** **	**0.45*** **
Grade point average (GPA)	**0.49*** **	**0.38***
Course grade		NS
Race		
Black	NS	
Hispanic	NS	
Asian	**-1.29*** **	**-1.20*** **
Male	NS	
Special population		
Special education	NS	
English language learner	NS	
Free or reduced lunch	NS	
Attitudes		
Personal course relevance		NS
Change in interest		**-0.85***
Expectancy-value-cost model		
Expectancy		**0.61*** **
Value		NS
Cost		NS

Interaction effect		
GPA x change in interest		**0.40***
R^2	15%	19%

Both prior achievement variables were statistically significant. We summed the coefficients multiplied by the value of each variable to calculate the model’s predicted logit value. Converting the logits into probabilities, the model indicates that an average student in the lowest quartile of the EXPLORE has a 65 percent probability of taking another course, whereas an average student in the highest quartile of the EXPLORE has a 90 percent probability of taking another course. The results are similar for GPA. An average student in the lowest GPA quartile has a 66 percent probability of taking another course, and an average student in the highest quartile of the GPA has a 90 percent probability of taking another course.

There was only one statistically significant demographic variable: an average Asian student has a 54 percent probability of taking another course, whereas an average non-Asian student has an 81 percent probability of taking another course. Regardless of their level of prior achievement, female students were just as likely to take another computer science course as were male students. In addition, African-American and Hispanic students were just as likely to take another computer science course as were Caucasian students.

In Model 2, we excluded the variables that weren’t statistically significant in Model 1 and then added the variables from the end-of-course survey along with the ECS course grade. We tested several interaction effects but only show the one interaction effect that was statistically significant. Again, the model was run using stepwise regression. As was the case for Model 1, both prior achievement variables and whether a student identifies as Asian were statistically significant in Model 2. Students’ perceptions of the personal relevance of their ECS course, the value of computer science as a field, and the costs of computer science don’t directly predict the probability of pursuing another computer science course. Neither does student performance in the course as measured by course grade. These were excluded from the final model.

Students’ expectancy for success in computer science was a statistically significant predictor of the probability of them taking another computer science course. An average student with low expectancy has a 69 percent probability of taking another course, whereas an average student with high expectancy has an 88 percent probability of taking another course.

Students’ change in interest in taking another computer science course interacts with their prior GPA to predict the probability of taking another course. Figure 1 provides a graphical display of this interaction effect. Average students who decreased their interest in taking another computer science course hovered around the average of 75 percent probability regardless of their prior GPA. Average students who increased their interest in taking another computer science course had a wide range of probabilities depending on their prior GPA. The probabilities ranged from 56 percent probability for students in the fourth quartile GPA to 93 percent for students in the first quartile.

Figure 1. Graph of the interaction effect of GPA and change in interest on the probability of taking another computer science course.

To better understand how the students' overall GPA interacts with change in interest in taking another computer science course in high school, we examined and categorized student responses to the open-ended questions about what students liked and didn't like about their ECS course. Specifically, we examined students in the fourth quartile GPA who increased versus decreased their interest and students in the first quartile who increased their interest. There weren't a sufficient number of students who responded to the questions from the first quartile who decreased their interest.

We were most interested in the extent to which students cited elements of the course associated with a traditional computer science course that emphasizes programming versus the elements of the course that highlight the uniqueness of ECS, such as projects that are relevant to students' lives outside of school. Students with a low cumulative GPA cited the project-based and programming elements of the course as what they liked the most with about the same frequency. A roughly equal number of students cited either the projects as what they like the most or learning programming. Likewise, students were as likely to say that the course needed more projects as they were to say that the course needed more time spent on programming. In contrast, students with a high cumulative GPA were more likely to cite the programing aspects of the course as what they liked the most. Students in the first quartile were much more likely to indicate that they enjoyed the programming aspect and felt that it should be increased. Some students in the first quartile even commented that they wished there was more differentiation so that they could spend more time on what interested them, namely, programming. Below are some representative examples of these kinds of responses that students provided:

- "I liked all the projects that we've done so far, and it makes us think really hard on how to solve problems that seem pretty simple at first." (Low GPA)
- "I like how we get to program things and learn what real computer scientists do. I also like working with Scratch to program sprites to do different things, too." (Low GPA)
- "I liked learning about HTML coding. It was interesting to see a little more about how the websites I use every day work. Using Scratch was fun, too." (High GPA)
- "I most enjoyed using Scratch and doing basic programming. It felt like I was doing the computer science concepts I imagine when I think of computer science." (High GPA)
- "I would actually like to learn something that would help me in the real world rather than using programs such as Scratch, which I won't ever use later in life.

Maybe for some people it will benefit, but the course should have a curriculum that should be helpful later in life." (Low GPA)

- "I would suggest that more of our work and projects be more creative and about us. For example, most of our Scratch games were based off specific game types that our teacher wanted us to make. I would have liked it better if more stuff was based off our own imagination and creativity or our own game types." (Low GPA)
- "I feel the class would have been more engaging if this class went even further into programming." (High GPA)
- "Next year, I would like to start using Scratch and the HTML codes earlier in the year. In this class, we used in the last few months. However, I liked those units the best. I would enjoy beginning them earlier." (High GPA)

In this paper, we set out to investigate whether students' experiences in Taste of Computing influenced the probability of taking further computer science coursework in high school. Students who took ECS as part of Taste of Computing already showed an interest in computer science since it was an elective class. This predisposition towards computer science also manifests in the fact that three-fourths of the students took another computer science class. Despite the overall high probability of taking further computer science, there were important factors that influenced that probability. There was not a direct effect of the personal relevance of ECS on the probability of taking another course. However, personal relevance of the ECS course has an indirect effect through its influence on students' expectancy for success, which in turn directly influences the probability of taking another computer science course, independent of students' prior achievement. These results are consistent with prior research on Expectancy-Value-Cost. Students with higher levels of expectancy increased the likelihood of taking another computer science course. However, our results don't replicate the gender differences that Dickhäuser and Stiensmeier-Pelster[21] found. Consistent with the equity strand of ECS, the effect of students' ECS course experiences on future course taking, as mediated by expectancy, was consistent for women, Hispanics and African Americans.

There are some limitations of this study. First, the teachers who volunteered represent a group with slightly more teaching experience from higher performing schools. In future studies, we'll make a concerted effort to recruit teachers from a representative sample of schools. These results might not hold up for contexts that are more challenging. Second, most of the teachers were in their first or second year of ECS. The positive effects of implementation might get stronger as teachers gain more experience. Third, Barron and Hulleman[23] have validated a shortened expectancy-value-cost instrument designed to be readily administered in school settings. In future work, we'll utilize their validated measure. In addition, we plan to incorporate other pedagogical measures[20] as a way to measure the effects of the three different strands of ECS.

Despite these limitations, this study provides preliminary evidence that the expansion of the ECS program into new cities is demonstrating the potential to reach students from groups underrepresented in computer science, to meet their goals, and to increase the probability that they pursue further computer science coursework.

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The reported study investigated the impact of the Exploring Computer Science (ECS) program on the likelihood that students of all races and genders would pursue further computer science coursework in high school. ECS is designed to foster deep engagement through equitable inquiry around computer science concepts. The course provides experiences that are personally relevant. Using survey research, the authors sought to measure whether the personal relevance of students' course experiences influenced their expectancies of success in and value for the field of computer science and whether those attitudes predicted the probability that students pursued further computer science coursework. The results indicate that students find ECS courses personally relevant, are increasing their expectancies of success and perceived value for the field of computer science, and are more likely to take another computing course.

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