Introduction and Need

In this CE21 special project, SRI International (SRI) proposes to significantly advance the field of assessment in high school computer science and computational thinking. SRI will partner with *Exploring Computer Science* (ECS) developers and teachers, and other experts and stakeholders in computer science (CS), computer science education and assessment, to continue work we started under a CE21 planning grant, *Planning for the Assessment of Computational Thinking*. The proposed special project, **Principled Assessment of Computational Thinking (PACT)**, will leverage materials and partnerships developed under the planning grant to design, develop, and validate assessments of computational thinking for the ECS curriculum. This project represents the logical next step in moving from an assessment framework and design templates, to using these materials to design and develop assessments that can provide value in a grade level that is critically important to moving students into the computer science pipeline to postsecondary studies. We are focusing on the NSF-funded ECS curriculum because, despite its comprehensiveness and clear value to the CS communities, it is not yet accompanied by a clear assessment framework or tools to measure computational thinking practices, and it provides instructors with only general guidance on how they should assess their students' computational thinking knowledge and skills. Using the ECS curriculum as a context for researching assessments of computational thinking will not only provide immediate value for ECS teachers and students, it can also provide longer-term value for efforts such as CS10k that aim to transform computing in high school by getting engaging, rigorous computing curricula into high school computing courses taught by well-prepared teachers.

Intellectual Merit

To date, computational thinking remains underspecified, particularly as a measurement domain. There are few clearly articulated and comprehensive assessment frameworks for guiding the development of assessment tasks for measuring computational thinking outcomes, particularly in high school computer science. The special project will bring together ECS developers, teachers, and students, and a wide variety of other experts and stakeholders in computer science, computer science education and assessment, to leverage materials and partnerships developed under a CE21 planning grant to design, develop, and validate assessments of computational thinking for the ECS curriculum. As our letters of support from Stanford, UCLA, and Santa Clara University show, the design materials and assessment tasks will not only provide immediate value for ECS teachers and students, they can also provide longer-term value for computer science community.

Broader Impacts

The ECS curriculum is currently reaching over 4,500 students throughout the country. It's acceptance as a "g" elective course in California is further proof of success, and pilots in Chicago, IL and possibly Puerto Rico will continue its expansion. As ECS continues to expand to reach even more locations and more students, teachers implementing the curriculum are going to need high-quality assessments so they can make valid inferences about students' computational thinking practices and better support the learning of those practices as students move through the curriculum. By co-designing formative and summative assessment resources with ECS teachers we will further increase the value and potential uptake of the ECS curriculum. Providing teachers with high-quality CT assessment resources will also lower barriers for adopting and using the ECS curriculum, as well as other pre-CS/CS curricula. The adoption and use of pre-CS/CS curricula like ECS will partly depend on the extent to which teachers feel it contains accessible and adaptable resources for assessing student knowledge and skills, and for reporting actionable evidence of student readiness to engage in further learning in the CT practices domain. This is particularly true when it comes to adopting and using curriculum designed for a typically elective subject area (i.e., pre-CS/CS is not typically a core subject area in high school) that the majority of high school instructors are not always well prepared to teach. The proposed special project is an especially important effort given the aims of the CS10K project in that it has strong potential to provide the new cadre of CS teachers with accessible and adaptable resources for assessing their students' CT knowledge and skills.