CT Readiness for All: Studying a Framework for Supporting Schoolwide Computational Thinking Integration Across Elementary Curricula

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ABSTRACT

Schools throughout the United States are engaging in efforts to integrate computational thinking (CT) across various elementary curricula. However, there is very little guidance for effective approaches to integrating CT consistently and cohesively school wide. CT Readiness for All is a two-year research project that is investigating a CT framework and self-assessment tool developed to articulate indicators associated with successful school-wide integration across elementary curricula. Data sources include focus group interviews and surveys with teachers. Although the project is still in progress, early analysis have resulted in three key findings: (a) students were able to make cross-curricular connections using CT as a problem-solving process; (b) finding time within the school day to focus on CT is challenging; and (c) administrators need to take an active role in setting the vision and definition of CT to support school-wide CT efforts.

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1 INTRODUCTION

CT is conceptualized as a set of concepts, skills, and practices for problem solving that draws from computer science (CS), involves computational devices and is applicable to many different disciplines in education [1; 2]. Research to date indicates that the application of CT improves students' ability with problem-solving and understanding of concepts in core-content areas [3; 4]. However, CT integration across elementary curricula requires a coordinated effort within a school to help develop students' skills outside of computer science (CS) classes. Additionally, schools need to engage in a continuous and intentional schoolwide effort to develop CT competencies across subject areas.

This project is conducting research to examine how schoolwide integration of CT in grades PreK – 5 contributes to developing the interest in and preparation for CS for students from diverse backgrounds. The goal of this project is to field-test the CT framework and self-assessment tool to investigate their promise for helping schools create school-wide CT integration plans, providing equitable access to CT education for underrepresented students in CS.

2 PROJECT DESCRIPTION

While there are many factors that influence the quality of CT integration, the CT framework provides educators with a tool to identify the specific variables that are likely to have an impact on integration efforts. The CT framework outlines hypothesized determinants of successful integration for educators to evaluate their readiness for, strategically plan for, and continuously evaluate progress towards school-wide CT integration by identifying six focus areas of successful integration: (1) Teacher Knowledge, Pedagogical Content Knowledge, and Facility with Tools to Support Student Learning of CT and Core Subjects; (2) Teacher Supports; (3)

Curriculum Features and Lesson Planning; (4) CT Assessment; (5) Student Impact; and (6) Families.

This study is investigating how elementary schools utilized the CT framework as a tool for integrating CT into their school settings, and the extent to which the implementation of the CT integration planning process results in students' increased access to and participation in high-quality CT instruction. During the first year of the study, we worked with six teachers from one school located in New York City. These six teachers included one Technology/Media teacher, two Pre-K through 5th grade Art teachers, one K through 5th grade Science teacher, one 3rd through 5th grade Social Studies teacher, and one K through 5th grade Gym teacher. Because these teachers each saw multiple classes, they worked with students with mixed abilities including English Language Learners and students with disabilities.

4 RESULTS

This project was designed to work with schools over an extended period to document the way in which the framework supports them with scaling and sustaining their CT integration efforts. Although the project is still ongoing, three preliminary findings were identified in early analysis of data.

4.1 *Students made cross-curricular connections of CT concepts in their work.* After engaging with the framework as a structure for developing a cohesive definition of CT and identifying the specific CT concepts and practices the school will focus on, the participating teachers noted hearing students in different content-area classes make cross-curricular references to how they were applying CT as a problem-solving strategy in their other classes. For example, one teacher in a focus group said, *"Students would actually go "oh I remember this in art, I remember this in technology" and the terms are starting to become more organic and understood, so I feel like that was a really great approach to introduce this as a tool you use anywhere, it's problem solving."*

The participating teachers noted that it was necessary for them to develop a shared understanding of the role CT will play in their curriculum and that in order to successfully integrate CT systematically across all classes, they needed to agree upon the specific CT concepts and approaches that will be the foundation for work. In early PD sessions, teachers revealed that they did not have a shared definition of CT, nor did they focus on the same CT concepts and practices, and this led to them all feeling as if they were working independently and not towards the same goal. They also felt that while there might be teachers who introduced CT as a part of their curriculum before participating in this project, it was sporadic and not in a unified way. By the end of the first year, the teachers reported that a successful outcome of their work was that they solidified a definition of CT and used the same CT vocabulary consistently across their classes.

4.2 *Finding time to integrate CT within content was challenging*. Teachers identified lack of time within the school day as a major challenge when undertaking CT integration. This sentiment was expressed both by teachers in the focus group and in the survey. In the survey, all five teachers stated that lack of time was a moderate or great challenge to integration.

4.3 *Administrators need to take an active role setting the vision and definition of CT to support school-wide CT efforts*. Teachers also identified the need for additional support from administrators as a key component to furthering their CT integration efforts. In the focus group, teachers stated that they felt as though they made significant process in the beginning of the school year but got to a place where they needed administrative input as to what their definition of CT is as well as the main CT concepts and practices administration wanted to see embedded into lesson plans to be able to move forward.

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