Abstract

Earlier this year, President Obama launched a bold new initiative: Computer Science for All. CS for All aims at empowering all American students, kindergarten through high school, to learn computer science and to be equipped with the computational thinking skills needed to be active citizens in our technology driven world. These problem-solving skills will be vital for career readiness in the 21st century; and, CS will be utilized in industries such as transportation, education, healthcare, and financial services. There is a need for computer science education for all students, especially young minority students. But it is not always clear how this should be done.

The purpose of this study is to explore ways in which teachers can bring meaningful CS experiences into classrooms.

This study supports research and development of curricula related to science, technology, and engineering. This research will provide teachers with insight for how to meet society’s growing demand for citizens that are literate in computer science by integrating CS with elementary math and science.

Method

Qualitative Data Analysis

- Participants: Five teachers at elementary school in Champaign, IL
  - The teachers integrated CS by utilizing Scratch throughout the 2014-2015 school year with the help of CS experts and prewritten lesson plans
- Data collection: teacher interviews and transcriptions, June 2015
  - Interviews focused on questions regarding collaboration, training/professional development, challenges, and successes of integrating CT into the elementary grades
- Creation of codes for interviews
- Data analysis: Constant Comparative Method
  - This method involves “inspecting and comparing all the data fragments that arise in a single case” (Silverman, 1993)

Definitions

- Everyday Math: math curriculum that spans pre-k through sixth grade and aligns with Common Core
- Computational thinking: a problem solving process that includes using a computer and tools to help solve problems, organize information, analyze data, create models, and identify and implement possible solutions
- Scratch: an online program that allows students to create interactive stories and games.

Results

Challenges of Integration:

- Difficult to find time for computer science
  - Teacher A stated: "hard to prioritize Scratch with tons of demand on new curriculum, teacher evaluations, and PARCC testing"
- Lack of teacher knowledge and comfort with computer science
  - Teacher B stated: “It’s something new to me and I don’t naturally think like a computer scientist. It takes extra effort for me, I’m not too familiar with the terminology or computational thinking”
- Lack of resources

Benefits and successes of integration:

- Student engagement and enjoyment
  - Teacher C stated: “Scratch lesson plans were an engaging platform for student learning…students were engaged and happy and having fun”
- Students improved critical thinking skills
  - Teacher B stated: “The thing that I like the most about this whole computer science thing is the way that it breaks down their thinking and really makes them think step-by-step what they’re doing and how they’re doing it”
- Student collaboration and communication

Implications for Practice

In order to accomplish broad integration of CT/CS into Everyday Math, there needs to be an increase in professional development and resources available for schools and teachers. Professional development needs to take place so that teachers have the opportunity to learn new computer science topics and lesson plans. Teachers must have a community of practice so they do not feel isolated. Coaches and mentors must be available for teachers. Schools also need resources available to them to be able to utilize Scratch and other similar CS programs. These resources include computers, software (Scratch), tech infrastructure (wifi, tech support, etc.), and lesson plans. It is vital that administration provides support for integration, giving teachers flexibility and permission to experiment and fail.

Future research must be expanded to include a more diverse set of teachers, and include student and administrative perspectives.

Conclusions

This study found that it is possible to integrate computer science and computational thinking into Everyday Math by utilizing Scratch. Major benefits of this integration include student engagement and success in both math and CT. Major challenges of this integration include timing and teacher knowledge of the content. This study is a critical first step to making computer science integration a reality in elementary schools across the nation.

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