What is the most effective way to deliver computer science instruction to elementary students?

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Rationale

During my 22-year tenure in public education, I have witnessed a significant transformation in computer science education within elementary schools. Specifically in Toledo's public elementary schools, the landscape has shifted from a structured weekly computer class led by a dedicated computer science instructor in a designated lab to a scenario where time is not allocated, there is no specified suitable location, and the responsibility now falls on the classroom teacher.

In today's fast-evolving technological landscape, it is imperative that students are introduced to computer science curriculum at an early age. Expecting an already burdened classroom teacher to teach this crucial skill without proper materials, time, or training is inadequate and substandard. As an educational district with a student population exceeding 21,000, we are failing our students by neglecting to equip them with the necessary technological knowledge essential for the workforce and higher education.

The purpose of this study is to examine the following questions:

- Do elementary students benefit from early computer science instruction?
- What is the most effective way to deliver computer science instruction to elementary students?

Literature Review

Computer science (CS) education has become a critical element of the US' efforts to keep pace with the growing number of CS jobs available in this country (Century, Ferris and Zuo, 2020-National Science Foundation, 2012). In 2023, OH averaged 13,722 open computing jobs each month with an average salary of $96,393 (Code.org, 2023). The goal of teaching CS at a young age is primarily to increase self-efficacy and motivation when engaging with science and technology (Friebroon-Yesharim and Mordechai, 2018). Research has shown that CS studies had some positive effects on cognitive development, thinking skills, problem-solving strategies, creativity, intrinsic motivation, or even social development specifically at young ages

(Friebroon-Yesharim and Mordechai, 2018). Further, computing skills are becoming essential tools for managing all aspects of our personal lives including finance, communication, and health, and for simply navigating the world we live in (Century, Ferris and Zuo, 2020).

Three parameters to establish effective learning: (1) the teachers must be confident and motivated; (2)the learning objectives should be realistic for the age of the students; (3) the development environment should be age-appropriate (Friebroon-Yesharim and Mordechai, 2018). Teachers can not be confident and realistic about age-appropriateness of technology standards without training. However, with a schedule that emphasizes literacy and mathematics, and other subjects competing for instructional time, creating opportunities for CS in the elementary school day is challenging (Century, Ferris and Zuo, 2020).

Study Design

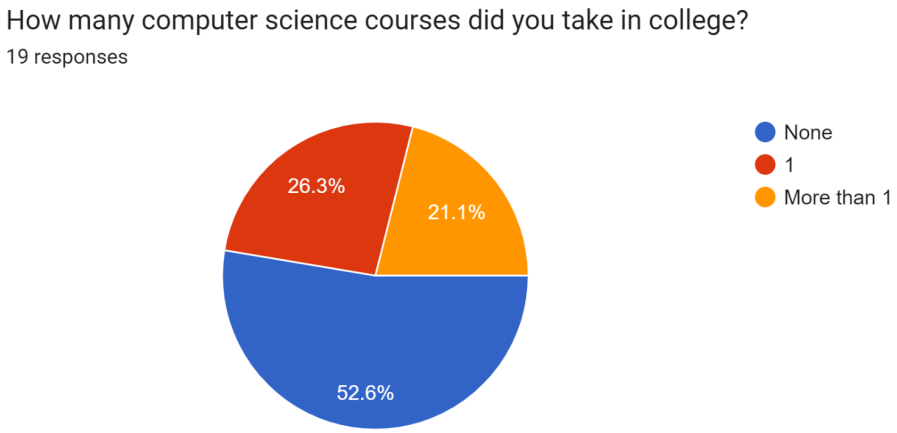
A survey was devised and circulated to volunteer elementary school teachers in my assigned schools to delve into the realm of computer science education. Nineteen teachers from two distinct STEM schools in the elementary public school system partook in this study. The survey encompassed questions regarding the teachers' educational background, experience, and confidence levels in delivering computer science instruction. It also sought insights into their existing practices in computer science education and their perceptions on their preparedness, in terms of both knowledge and resources, for imparting such instruction.

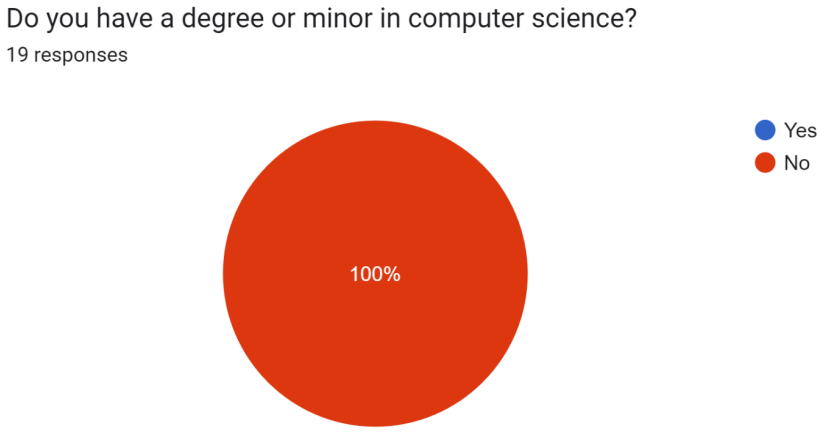
Analysis of Data from a School District Without Computer Science Courses at the Elementary Level

The data presented in this analysis was acquired from a school district where computer science courses are not offered at the elementary school level. In this setting, classroom teachers bear the responsibility for delivering all technology-related instruction. Notably, more than half of the teachers who participated in the survey indicated that they have never undergone any formal training in computer science. Additionally, none of the teachers surveyed

possessed a computer science endorsement or had pursued a minor in computer sciences during their education.

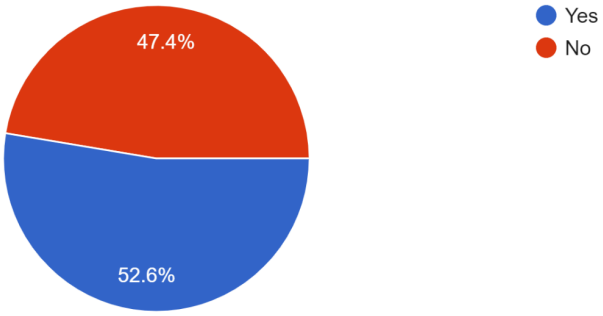
A substantial percentage, 47.4%, of the surveyed teachers expressed concerns regarding the availability of materials, equipment, supplies, and adequate space to effectively integrate a computer science curriculum into their teaching practices. Strikingly, an overwhelming 94.7% of teachers articulated that the current resources in computer sciences fell short in addressing the diverse needs of the student population.





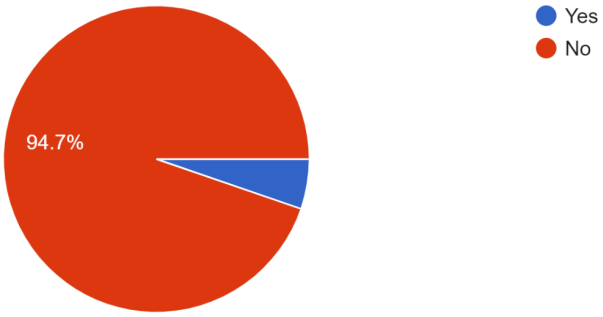
Do you have the materials, equipment, supplies and space to implement a computer science curriculum in your classroom?

19 responses



Do you believe that the existing computer science curricular resources meet the needs of a diverse student body?

19 responses



Recommendations

In summary, it is imperative to reintroduce computer science courses into the curriculum of elementary schools. The most effective approach to delivering this vital education is through the implementation of a comprehensive K-8 curriculum and the engagement of educators who hold endorsements in computer science to impart the knowledge and skills required for this digital age.

I strongly advocate for the reintroduction of computer science as a dedicated "special" subject in every K-8 school. Under this proposed initiative, students would partake in

age-appropriate computer science lessons facilitated by qualified educators twice a week for 30 minutes each session. These lessons would be enhanced with the provision of necessary equipment to optimize the learning experience and ensure comprehensive skill development in this crucial field.

References

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