On Computational Thinking: A Perspective From Rural Saskatchewan

Episode 3: Why Teach Computational Thinking To Elementary Students? Script

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"But writing programs for computer graphics or music and flying a simulated spaceship do share very much with the real activities of adults, even with the kind of adult who could be a hero and a role model for an ambitious child" (Papert, 2020, p. 201). This is from Seymour Papert speaking on computers and computer cultures in the book *Mindstorms* from 1980. I learned eventually - probably in my late teens, that heroes are not necessarily those we find in comic books and movies, but heroes are the everyday people that inspire us, that aid us, that teach us.

After many years teaching in middle years and high school classes, I returned this year to a regular role in an elementary grade. It's been a while, and I forgot how rewarding it can be. I have been moved by the excitement that my students get when they are able to recognize patterns in mathematics, when we cheer and laugh together while creating a story in drama class, when I show up to take the kids to fly drones, or when a grade one figures out how to spell meow.

I'm Stephen Hadden and this is episode 3 of my series exploring computational thinking in education. Today we are looking at some reasons why we should teach computational thinking to elementary students.

As much as my students are inspiring me this year, I hope that I can inspire them a little, that all of our teachers and educators can inspire them. That we can encourage them that mathematics is fun and challenging, that stories and knowledge from our elders is important, and that we need to treat each other with kindness. For me, exploring ways of using computers to be creative, to communicate through media, to understand mathematics better, or to build robots is hopefully inspirational.

The current curricula in Saskatchewan does not directly reference computational thinking, however it mentions technology as a useful tool, and as stated in the *What Is Computational Thinking*? episode, computational thinking can be explored through a number of outcomes across curricula. From the Science 3 curriculum, "Technology serves to extend our powers of observation and support the

sharing of information. Students should use a variety of technology tools for data collection and analysis, visualization and imaging, and communication and collaboration throughout the science curriculum" (Saskatchewan, 2011, p. 3) The Grade 5 mathematics curriculum encourages a number of applications of technology, like organizing data, simulating situations, and developing number sense (Saskatchewan, 2008, p. 5). And so it's in there, it may not be labelled computational thinking, but it's there. Prior to the renewal of Ontario mathematics curricula, Hennessey, Mueller, Beckett, & Fisher penned an article in 2017 identifying computational thinking concepts throughout Ontario curricula - the concepts were concentrated in mathematics documents, but were also located elsewhere (Hennessey et al., 2017). They noticed that computational thinking practices were not prevalent, and should be better integrated. We would likely find similar results in an evaluation of Saskatchewan curricula.

But there may be need to take things a step further. Around the world, technology instruction, including computational thinking and coding, is being carried out increasingly in elementary grades and more explicitly expressed in curriculum and learning expectations. (Erstad et al., 2021; European Commission et al., 2022; European Commission. Joint Research Centre., 2016; Ontario Ministry of Education, 2020). This makes sense. Kids have their hands on technology from a very young age, and although they seem to be technologically savvy, they know how to do very few things very well. Their digital literacy or technological abilities can be very limited (Wood, 2022). There is every reason to expect that the same inclusions should happen in Saskatchewan classrooms, and with Saskatchewan curriculum documents.

Here are a few reasons why it may be a good idea to focus more on computational thinking and coding even in elementary grades: Technology skills are increasingly necessary in high school, university and the workforce "There is a substantial gap between what schools are teaching and the job skills that students' future employers demand" (Berger, 2022). But you might be saying hold on a second. This is grade 3 you're talking about. And that's true but imagine what advancements might be possible within

the next ten years and what these grade 3's could be working with by the time they graduate high school.

There must also be the consideration of a student's digital literacy while remaining constantly connected. There is a great need to help them understanding the workings of a computer, not just to ensure they can operate technology, but that they can grasp the concepts of ethics related to technological use and applications like artificial intelligence. There are lots of ethical and moral considerations that we are now asking computers to make decisions upon. It might be relevant to ensure our students understand makes their behaviour personally responsible, and what the moral behaviour of artificial intelligence might entail (Seoane Pardo, 2018).

And I think I have saved my favourite point for last. Now these are small studies, but some recent research from Arfé and associates (Arfé et al., 2019, 2020) shows that there appears to be a positive relationship between executive functioning and coding in grade 1 students in the United States. The students who were doing coding with code.org showed a larger improvement in planning and response inhibition than the students who did not. This is by no means definitive, and there is need for more studies of this kind, but it's an interesting result, and might be a good reason to look into coding for younger children.

I want to see our students succeed with technology - it's a pretty tough battleground. When it comes to using computers, distractions are common, and they can allow us to avoid thinking through complex problems - I mean we can get AI to write a passable paper on pretty much any topic. We have so many tools to make things easy - too easy. And it may be that technology is making society just a little bit worse. Papert was one to warn of this potential, ”As knowing how to use a computer becomes increasingly necessary to effective social and economic participation, the position of the underprivileged could worsen, and the computer could exacerbate existing class distinctions” (Papert, 2020, p. 27).

This seems spectacularly accurate for something written in 1980. As educators we can help to level the playing field, if we shift our focus a bit. Many schools are embracing 1:1 technology device programs, providing a tablet or laptop for each student's use for the school year. With such universal access now becoming available for all our students, regardless of socioeconomic background, we should be supporting our students to make full use of these learning opportunities (Berger, 2022). As educators, we must not leave our classroom technology to one period a week, or just see our devices as free period tools, or as digital worksheets / textbooks. We have to be willing to provide opportunities for students to get to create with their devices, and that that they learn a little bit about coding even when young. They will benefit by having these very important skills in their tool kit. These skills might be just as necessary for their future success along with a strong foundation in ELA and mathematics.

In the Next episode, we will hear from Melissa Lander. Melissa is a learning consultant in Sun West School Division, she is responsible for curriculum and instruction. It is very fitting to have our instruction consultant share on what might be important about computational thinking. Until next time, I'm Stephen Hadden.

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