Graduating Project Proposal
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Introduction

  In this project, I am looking to explore coding to learn, the use of coding as a learning tool in my classroom. I have chosen this direction because of personal experience, research (Papert, 1971a, 1971b), and expert opinion (Resnick, 2012) supporting the effectiveness and richness of coding as a learning tool to help students learn a wide variety of skills, many of which have been identified as desirable 21st century competencies (Premier's Technology Council, 2010). Some of the skills that are typically learned through the process of coding are: design process skills, meaningful experimentation and tinkering, computational thinking (which involves perceiving and understanding a larger problem and then breaking it into simpler parts), debugging and problem solving, communication, metacognition, and persistence and perseverance (Martinez & Stager, 2013; Resnick, 2013).

  21st century skills are often framed in terms of employability and marketability (Premier's Technology Council, 2010); while I certainly value helping my students develop employable skills, I would also like my students to approach skill development with a more intrinsic motivation, such as developing citizenship and experiencing self-actualization. Learning to code can support this goal when students have choice in terms of what they are coding, and when students collaborate with others, both within and outside of the classroom (Martinez & Stager, 2013; Papert, 1971a; Resnick, 2013). 21st century skills often focus on confident and fluent accessing of resources and interacting with others (Premier's Technology Council, 2010); while I value supporting my students to become confident and competent users of any tool or system, I also would like to teach and empower them to participate in design and creation of objects and systems. Learning to code can support this goal by empowering students to design and create digital projects. It is also possible to extend this to physical projects, through the use of robotics and other fabrication tools (Martinez & Stager, 2013; Resnick, 2013)

  Finally, taking a maker approach to coding can help support my students to feel ownership over their creations, and to develop self-confidence and positive risk taking. The maker approach celebrates learners identifying their own goals, tinkering, or experimenting with possibilities to achieve those goals, and then building on what they discover (Martinez and Stager, 2013). I would like to give my students the freedom to be self-directed tinkerers while coding and making, to help build confidence, and also to make students feel ownership over their work, while making success possible for all students without putting any limitations on creativity or complexity.

  With all of these considerations in mind, I would like to explore coding with my students through several coding languages and interfaces. I would like to look at increasing complexity throughout the school year (i.e. starting with a simple interface ipad app, and moving towards more complicated programming), so that students can apply and advance their learning.

  My use of digital technologies with my students will include some sort of social media to support collaboration, sharing, and peer to peer teaching. I have done this in the past using

blogging and Edmodo, and have found both of these tools to be effective in encouraging and facilitating social and academic interaction between students. I would also like to explore the possibility of networking with others outside the classroom, including other classes, or other users of coding software. Finally, depending on student progress, I would like to provide students with an opportunity to bring their creations to life, using a tool such as the Makey Makey, or robotics tools.

Inquiry Question

For my inquiry, I want to explore how my students can benefit from learning to code, and how to best plan and implement my coding program to engage and support all learners. Specific questions I will explore will include: How can learning to code support my students' learning of 21st century skills, including creativity, problem solving, design skills, metacognition, communication and collaboration, and computational thinking? How can I set up how I teach coding in my classroom in order to encourage and support tinkering, experimenting, confidence, and positive risk taking in my students? What level of direction, support, and guidance is necessary in order to strike a balance between supporting and teaching my students while also allowing for creativity and self-directed learning? How will students' unique learning needs affect this? To what degree will opportunities to create physical manifestations of projects affect student engagement and motivation?

Inquiry Purpose

As outlined in my introduction, my inquiry will likely be beneficial to my students, through supporting their development of important skills, competencies, and confidence. I myself will also benefit by learning to better direct and focus my practice, and expanding my teacher toolbox. There is also the potential for other teachers to benefit from my documentation of my learning and lessons I create in the process of implementing my inquiry.

Key Concepts

Coding to learn

"Coding to learn" refers to the rich academic context created by learning to code computer programs. Learning coding is not about a single end goal of being able to program a computer; it is a process through which children (and adults) can learn numerous other skills and competencies. Through coding, students learn mathematical and computational thinking (which requires breaking down complex problems and ideas into simpler parts), problem solving strategies, design processes and thinking, metacognition, communication skills, self-expression, empowerment, persistence, and perseverance (Resnick, 2012, 2013; Papert 1971a, 1971b).

Metacognition

Metacognition refers to an awareness of one's own thinking (Dinsmore et al., 2008). One of my goals in my masters project is to help my students in the development of metacognition. Solomon and Papert (1976) suggest coding can be an effective means to this end, through a coding process outlined for learners. This process involves planning what needs to be done, modeling the actions the computer will take (modeling could involve drawing, story boarding, or physically acting something out), thinking about how the actions were completed in the model, teaching the computer to do the same thing, and then thinking about why it did or did not work. Making this process explicit can encourage metacognition by forcing students to break their thinking down into steps and become aware of each step.

Constructionism

   Constructionism, developed by Papert, is rooted in constructivism. Constructivism is the theory that learning is not a passive process of transmission of information; it is an active process of making sense of the world, which happens best when participating in authentic, hands on experiences. Constructionism focuses specifically on the construction of knowledge through the process of constructing or making something shareable (Martinez & Stager, 2013). Through my masters project, I hope to create opportunities for my students to engage in authentic, self-directed creation; to further support their learning, I will then help them reflect in meaningful ways to make sense of their experiences and construct knowledge from them.

Ethical Considerations

   There are several ethical considerations that are relevant to my project. It will be important to communicate clearly with both students and parents that I am working on my project and what it is about. I will need their consent to participate in my inquiry, as well as to use any student work for documentation of my project. I will need to ensure that any software, hardware, or online tools that I use are approved for use by my school and school district, and also by parents. If I use any online programs that store data outside of Canada, and/or programs that require student information (such as names and email addresses) for registration, I will need to ensure full student and parental awareness of privacy issues, and have consent for students to use these programs. As I would like to encourage my students to join online learning communities for the sake of both learning and teaching, I will need to consider risks to student privacy and online safety, and have parental consent for when students interact online with others outside the school community.

References

Dinsmore, D. L., Alexander, P. A., & Loughlin, S. M. (2008). Focusing the conceptual lens on metacognition, self-regulation, and self-regulated learning. *Educational Psychology Review, 20*, 391-409

Martinez, S. L. & Stager, G. (2013). *Invent to learn: Making, tinkering, and engineering in the classroom.* Torrance, CA: Constructing Modern Knowledge Press.

Papert, S. (1971a). Twenty things to do with a computer (Report No. LOGO-3). Cambridge, MA: Massachusetts Institute of Technology. Retrieved from ERIC database. (ED077240)

Papert, S. (1971b). Teaching children thinking (Report No. LOGO-2). Cambridge, MA: Massachusetts Institute of Technology. Retrieved from ERIC database. (ED077241)

Premier's Technology Council. (2010). *A Vision for 21st Century Education*. Retrieved from http://www.gov.bc.ca/premier/technology_council

Resnick, M. (2012). *Let's teach kids to code.* Retrieved from http://www.ted.com/talks/mitch_resnick_let_s_teach_kids_to_code?language=en

Solomon, C.J. & Papert, S. (1976). A case study of a young child doing turtle graphics in LOGO. (Report No. LOGO-28). Cambridge, MA: Massachusetts Institute of Technology. Retrieved from ERIC database. (ED207578)