Programming in Physics? You Bet!

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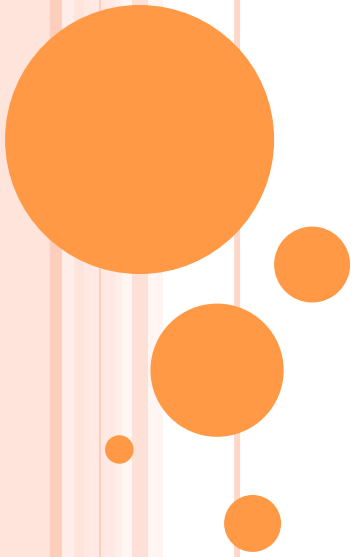
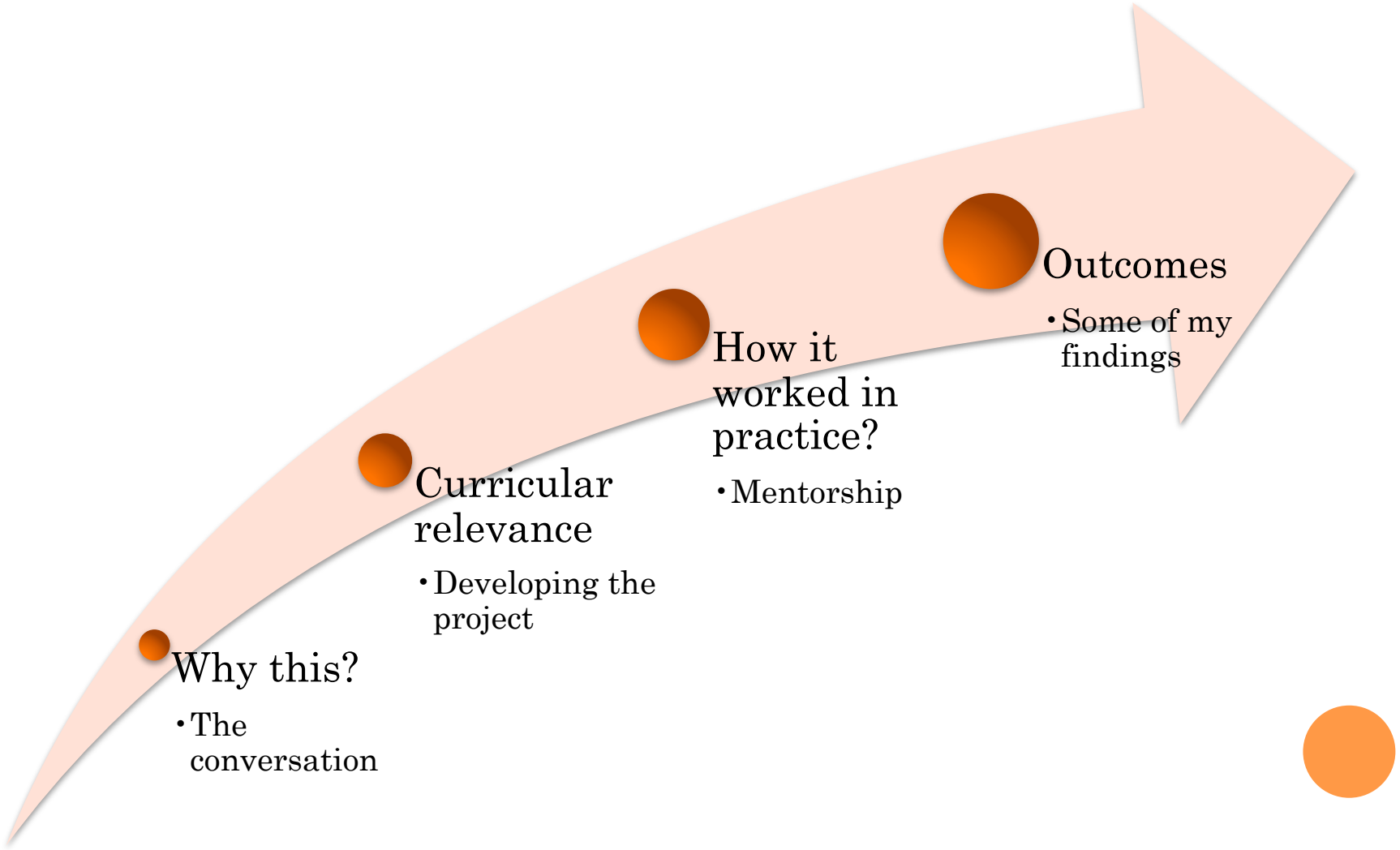
Programming in Physics? You Bet! Outline

- Part 1: Incorporating Programming into the class
  - Why I decided to do this
  - How I've done it with my classes
  - Some results and feedback from students
  - Some challenges
- Part 2: Programming platforms
  - Programming languages
  - Programming platforms and engines
  - Let's try them out!



Part 1: Incorporating Programming into the classroom

Incorporating Programming into the classroom: one practitioner's experience



WHY THIS PROJECT?

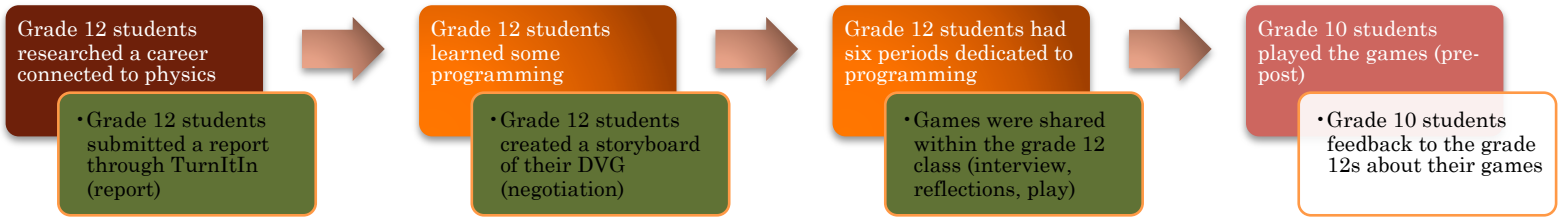
- The conversation
- Some research
  - *The Technology Outlook for STEM+ Education 2013-2018*,
    - Recommendation to include computer coding as part of the mathematics curriculum rather than having coding exist as a separate electives course (Johnson, Adams Becker, Estrada, & Martin, 2013).
  - Others echo this recommendation but rather than limit its inclusion to mathematics they suggest that coding be incorporated into other disciplines as well (Code.org, 2013; Repenning, et al., 2015).

Curricular Relevance

- The computer-programming/physics-related careers project was designed for two reasons:

1. to introduce students to the fundamentals of computer programming as a way to develop both their computational thinking (CT) and to express their findings on careers related to physics;
2. introduce grade 10 students to different careers in physics

How it worked in practice



Learning some programming

- Using the Hour of Code (Scratch), taught students about:
  - Variables
  - Loops
  - Conditional statements

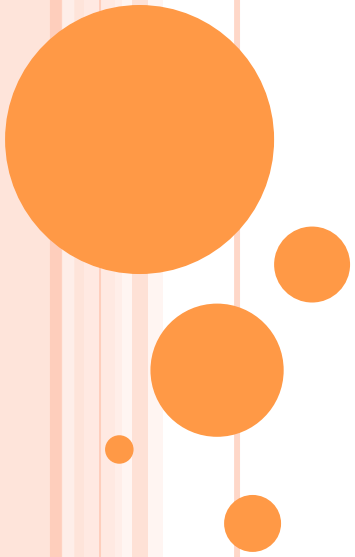
Some findings: Grade 12 students

Some Feedback

- *Since starting this project, feedback has been positive from returning graduates.*
- *Students ranged in the prior skill level with computer programming from non-existent to very advanced.*
- *Students differed in their opinions regarding being grouped based on skill level.*

Some challenges

- Access
- Connectivity
- Curriculum
- Debugging



Part 2: Programming languages & Platforms

Programming languages & Platforms: Students selected…

Students used..

- C# ✔
- Hopscotch
- Java Script
- Python
- Scratch ✔
- Turbo C++
- Turing

Developers & programmers use…

- JavaScript
- Java
- PHP (Hypertext Preprocessor)
- Python
- C#
- C++
- Ruby
- CSS
- C
- Objective-C

Programming Languages & Platforms: Platforms & Engines

Engine	Website	Languages
Beyond the Hour of Code	https://code.org/learn/beyond	HTML, JavaScript, Python
Eclipse	https://eclipse.org/	C, C++
Hour of Code	https://code.org/learn	Scratch
Hopscotch	App on iPad	Visual programming
Pygame	http://pygame.org/hifi.html	Python
Unity	https://unity3d.com/unity	C#, JavaScript
Wade	http://clockworkchilli.com/	HTML

Others?

Thank you for participating in this workshop!

References

- Code.org. (2013). *About Us*. Retrieved from The Hour of Code: https://code.org/
- Johnson, L., Adams Becker, S., Estrada, V., & Martin, S. (2013). *Technology outlook for STEM+ Education 2013-2018: an NMC Horizon Project Sector Analysis. Austin: The New Media Consortium*.
- Repenning, et al. (2015). Scalable Game Design: A Strategy to Bring Systemic Computer Science Education to Schools through Game Design and Simulation Creation. *ACM Transactions on Computing Education, 15* (2), 31. DOI: http://dx.doi.org/10.1145/2700517
- Widman, J. (2016). The most popular programming languages of 2016. *New Relic*. Retrieved from https://blog.newrelic.com/2016/08/18/popular-programming-languages-2016-go/

ASSIGNMENT USED IN MY CLASS

- The project is was completed in four parts:
  - Students conduct research on a career connected to physics and write a brief report to answer the following questions: What is the career? Where could you study this (must include one location not in Canada)? Identify what kind of courses you would take while in school. Identify what prerequisites you need to have in order to enter a formal education in this field. Explain why you are interested in this area. [This is a brief assignment with a 500 word maximum. Students submit the assignment through TurnItIn.com).
  - Students are then grouped based on common career interests (rather than programming expertise) and asked to produce a storyboard of a game that would teach the player about the career. The storyboard includes: programming language, career, goal of game, levels (maximum three). [This is done to ensure students are being realistic in what they would program in the given time frame].
  - Students program a basic game to teach the player about a career. The player should be able to have a conversational knowledge about the career after play. The program must include: conditional statements and loops [I give students 6 class periods where I have booked the cross curricular labs].
  - [One class students then play each others' games. I have individual interviews during this time to ask students about the code]
  - The final portion is mentorship. I have had my grade 10 classes then play the grade 12 games. The grade 10's provide feedback to the grade 12s about their games. [The grade 10s are asked about their career knowledge before and after play.]