

Understanding Student Computational Thinking with Computational Modeling

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Overview

- Introduction
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- Assessment Methods
- Assessment Method: Proctored Programming Assignment
- Assessment Method: Essay
- Assessment Method: Interview
- Discussion



Virginia

Introduction

- Master's Computer Science with HCI certificate
 - Virginia Tech (2012-2014)
- Bachelor's Computer Science/Information Assurance
 - Norfolk State University (2008-2012)
- Thesis Topic: Mobile Exergaming and Increasing distribution of mobile exergames





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Summary of Paper

- 9th Grade Physics Course
 - Worked with an in-service high school physics teacher
 - Vpython programming environment
- Fall Semester:
 - Developed Computational models of four Modeling Instruction force and motion models

Summary of Paper contd.

- Two separate 9th grade physics classrooms with 32 students
 - Each student had access to Vpython via laptop
 - PhysUtil module
 - Geogia-Tech developed Python module
 - Designed specifically to support the Modeling Instruction curriculum





Assessment Methods

- Three separate assessments
 - Proctored Programming Assignment
 - Essay
 - Interview





Assessment Methods: Proctored Programming Assignment

- Two Vpython programming assignments
 - 1st: students were given a Code Checking Case
 - 2nd: "Grading Case"-students were not given the answer/solution
- Found that high school students can engage in Computational Thinking in the context of Physics



Assessment Method: Essay

- Investigated whether students' success was predicated on simply reproducing an algorithm or whether deeper connections between physics and computational thinking were made
- Students were asked to describe the integration loop mathematically, physically, and programmatically

Assessment Methods: Essay

- Explanations captured in four groups:
 - Force-casual: characterized by a clear connection between force and motion
 - Kinematic-observational: did not make connection between force and motion
 - Iterative-local: characterized by a discussion of incremental steps through the loop
 - Mixture of the three view

Assessment Method: Interview

- 5 students completed the interview
- Interviewed students while they filled in missing pieces of a scaffolded computational model
 - answered questions regarding to force, motion and integration loops



Results

- 1/3 of students successfully completed individual assessment
- Student success on proctored assignment was closely tied to how students synthesize knowledge of physics and computation





Discussion

- Would this course be considered as Computational Physics?
- Do you think having a three part assessment is an efficient way to gather results regarding computational thinking?

