Computational Thinking for Computer Science Majors: An Introduction to CS Education Career Pathways

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Introduction

In general, computer science majors do not consider K-12 education as a career pathway. A potential reason is a lack of introduction to the career path during their undergraduate careers. This pilot course was designed to introduce computer science majors to education as a career path, give them a classroom experience, and provide a way for education students to learn about and use computational thinking techniques while working with computer science students in integrated groups.

The Plan

Step 1: Introduce computational thinking (CT) to the CS and education students, basing lessons on Krauss and Prottsman.[1]
Step 2: Introduce CT manipulables to the college students and discuss ways of integrating them in the classroom.
Step 3: Have the college students develop lesson plans using these manipulables for use in K-8 classrooms then have them run those lessons.
Step 4: Have the college students reflect on their successes and concerns from the classroom experience.

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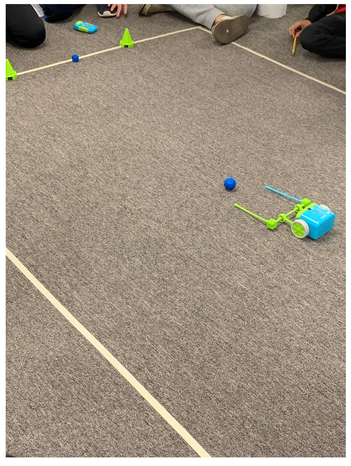
The Execution

The college students were introduced to the various CT manipulables and example lesson plans at the beginning of the semester. Then, they were challenged to create lesson plans, including identifying articulation to the existing Maryland CS Standards. Later, groups of CS and education students were able to run these lesson plans with grade 3-5 and grade 6-8 students.

SMCM student-planned lessons included:
- Rubik's cube algorithm
- Block building challenges
- Botley soccer
- Makey-Makey pianos
- Mouse trap powered cars
- Sphero mazes and races

Pictures of grade 3-5 activities



Pictures of grade 6-8 activities

*pictures used with parental permission

COVID-19 Conundrum

Unfortunately, after only three in school sessions, both the SMCM students and the CPCS students moved to virtual learning.

While the SMCM students continued their work in the course, the interaction with the CPSC students was ended. The SMCM students were then challenged to come up with CT questions that could pair with existing free activities that then could be used in remote settings.

Lessons Learned

We planned to measure change in understanding of CT by using a modified BEBRAS test, as well as gauge CS student's pre/post attitudes toward education careers.[2] Unfortunately, the virtual environment caused by COVID-19 lead to a decrease in participation for the post test and a lack of measurable results. Anecdotally, we know of at least two additional CS students (out of 12) who are now considering education as a career, one who is moving on to an MAT program. Additionally, those who took both tests saw a 10 percentage point increase in computational thinking ability, as measured by the BEBRAS test.

References

[1] J. Krauss and K. Prottsman. *Computational Thinking and Coding For Every Student: The Teacher's Getting-Started Guide,* Corwin, 2016.

[2] J. Lockwood, A. Mooney. "Developing a Computational Thinking Test using Bebras problems," Joint Proceedings of the CC-TEL 2018 and TACKLE 2018 Workshops, co-located with 13th European Conference on Technology Enhanced Learning (EC-TEL 2018), 03-09-2018.