Evaluating Computing Knowledge for BJC

Elisabeth Frasch, Mentors: Barry Peddycord III, Dr. Jen Albert, Dr. Tiffany Barnes
{erfrasch, bwpeddyc, jlsharp, tmbarnes}@ncsu.edu
North Carolina State University Research Experience for Undergraduates in Computer Science

broadcast Introduction

- The Beauty and Joy of Computing (BJC) is a new course used to introduce computer programming concepts in high school to students with little to no experience
- The main tool used in the curriculum is SNAP, a visual, drag-and-drop programming language derived from Scratch
- One week professional development workshops were led at several universities in order for high school teachers to prepare for teaching the class themselves
- There is little research on what makes for the best professional development in Computer Science, and there are no validated instruments that we know of to measure advanced computing skills and concepts

move 7 steps

- We look at Brennan and Resnick's framework from *"New Frameworks for Studying and Assessing the Development of Computational Thinking"* in order to create a pre and post assessment, given to the teachers before and after the development session
  - **Sequences**: a particular activity or action that is expressed as a series of individual steps that can be executed in order by computer
  - **Loops**: Mechanisms for running identical sequences multiple times
  - **Events**: "One thing causing another thing to occur"
  - **Parallelism**: Sequences of instructions happening simultaneously
  - **Conditionals**: Making decisions based on certain conditions, which can support multiple outcomes
  - **Operators**: Enable the programmer to preform numeric and string manipulations through mathematical, logical, and string expressions
  - **Data**: Storing, retrieving, and updating values such as variables and lists

pick random Test Question Examples

2. What does the following script do?
(Check all that apply):

A. Says a number between 10 and 40 (inclusive)

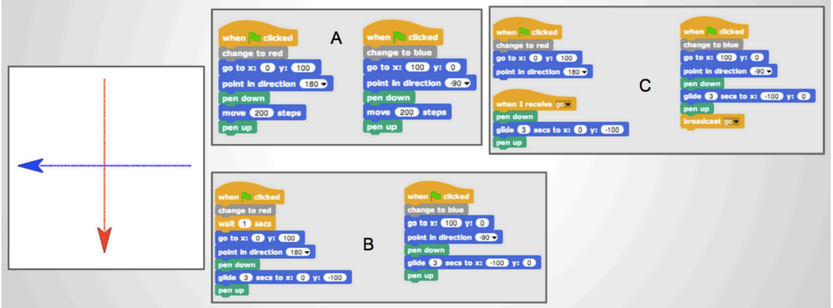
B. Adds 4 random numbers together and says the average of them

C. Resets "x" 4 times and randomly divides the last setting by 4

D. Says a number between 1 and 10 (inclusive)

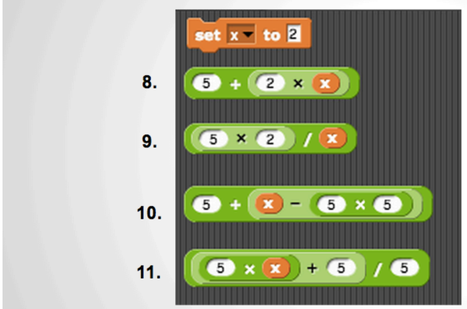
(Question 2 concentrates on the Sequence and Data concepts, and requires the participant to analyze the script of code in order to determine its function)

7. Which of the following programs guarantees that the red line will overlap (be on top of) the blue line?



(Question 7 concentrates on the Parallelism and Events concepts, and requires the participant to analyze each possible answer to determine which has the desired outcome)

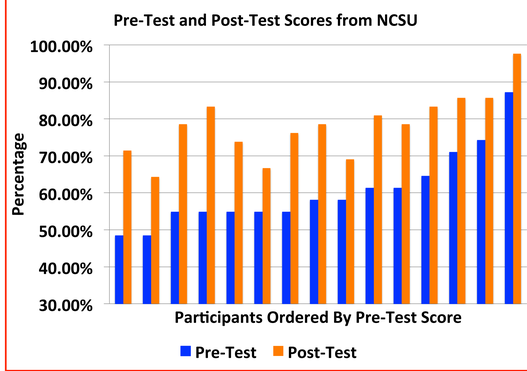
Match the operator blocks on the left with the corresponding answers on the right



A 5
B -23
C 3
D 9
E -18

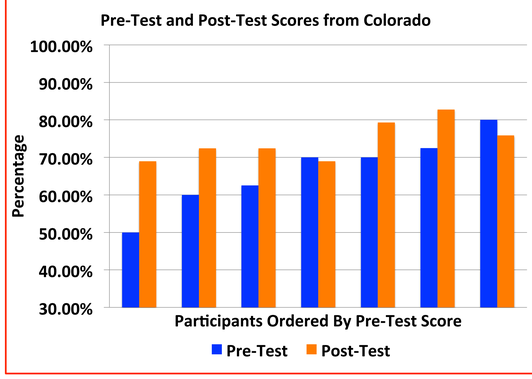
(Questions 8-11 concentrate on the Operators concept, and requires the participant to analyze each line of code to determine its numerical output)

insert Results



Average Pre-Test	Average Post-Test	Average Growth
60.43%	78.25%	17.82%
SD Pre	SD Post	SD Growth
0.1031	0.0858	0.0528

A positive growth from the Pre-Test to the Post-Test can be seen for all participants. One participant was excluded due to blatant pattern guessing in the Post-Test.



Average Pre-Test	Average Post-Test	Average Growth
66.43%	74.38%	7.96%
SD Pre	SD Post	SD Growth
0.0977	0.0521	0.0795

The average scores of the pre-test were higher this workshop than NCSU. However, the average growth from Pre-Test to Post-Test was far lower than that observed in the NCSU data.

play Conclusion

- We can conclude that:
  - The organization and methods used in the NCSU workshop was very effective in providing an ample environment for professional development
  - With little to no previous experience with SNAP!, teachers with a CS background can successfully answer approximately 50% of the tests questions
    - Reinforces that the concepts demonstrated on the test are computational thinking skills and not specific to SNAP! even though they are displayed in the SNAP! language.
- The next steps would be to analyze the formatting and structure of the professional development session in Colorado and conduct interviews with the participants

Acknowledgements: Thank you to Wilmaris Rivera Medina, Keishla Sanchez Ortiz, Reniel Irizarry- Del Toro, and Gerardo Serrano Rodriguez for their help in creating and revising the test questions. This work was partially supported by NSF grant IIS-1262899.