Educational Impacts in Computer Science
Javin Unger and Dr. Serita Nelesen, Department of Computer Science

Abstract

Computer science changes quickly, so computer science pedagogy must also evolve. In these studies, we evaluate interventions that impact how introductory computer science students learn. We analyzed multiple forms of data and were able to observe trends. Through our analyses, we sought to:

• Determine the impact of the introductory computer science course language
• Determine impact of a parallelism exercise in a data structures course
• Determine the impact of a values affirmation intervention (2) in a computer science context

To accomplish these goals, data from physical and digital copies of final exams, concept inventories, programming exercises, and values interventions were anonymized and encoded.

Impact of Introductory Language

• In Fall 2014, the introductory course (108) language was changed from Java to Python.
• Student grade data since 2012 for CS1 and CS2 (112) were analyzed to determine how students’ grades changed from 108 to 112.
• The general trend remains consistent across both introductory languages: strong CS1 performance correlates with success in CS2.

Parallelism in CS2

• Students of the Spring 2015 CS2 course were divided into near-equally sized groups based on which lab/project they performed: the image group or the matrix group.
• Total Students: 47
• Image Group students: 20
• Matrix Group students: 27
• Each student answered 5 final exam questions related to parallelism:
  • ‘QA’-‘QD’ were control questions used in previous semesters.
  • ‘QE’ was designed to determine students’ understanding of the Parallel Loop pattern.

Values Affirmation in CS1

• Students in introductory computer science courses in Fall 2012 were randomly assigned a writing exercise (not related to computer science) which had them write about their own or others’ values (2).
• “Positive (+) affirmation” refers to writing about one’s own values, and “negative (-) affirmation” refers to writing about others’ values.
• Total Students: 139
• Male / Female: 112 / 27
• Male +/- Affirmation: 57 / 55
• Female +/- Affirmation: 11 / 16
• The writing exercise was completed during class within the first month of the semester.
• At the end of the semester, students were asked to complete concept inventories (f) which tested their comprehension of basic computer science concepts.

Gender Implications

• In the affirmation study, we first noticed that women achieved better grades than men.
• We then considered grades throughout all semesters of introductory programming by gender.

Conclusions

• A student’s introductory language has no significant effect on their transition to the next course.
• Image processing operations teach parallelism better than matrix operations.
• Female students in introductory CS courses tend to perform better than their male counterparts.

References & Acknowledgements


Special thanks to Professor Joel Adams and his research students for all of their work on TSSU, and their contribution to our work this summer. We would also like to acknowledge the Jansma family for their generosity which made this research possible.