

Need:

Lower division undergraduate courses in Computer Science such as Data Structures and Algorithm Analysis are points in the curriculum where students are introduced to critical foundational concepts. Long-term retention of these concepts is essential, however, the absence of context or their connections to real-world applications can decrease student motivation. Grounding Computer Science concepts by solving important real-world problems or fun problems can be keys to increasing students' engagement in computing and their subsequent success.

Guiding Questions and Context:

1. Improve the retention of Data structures and Algorithms knowledge using BRIDGES, a software framework for building engaging assignments.
2. Assess immediate and long-term gains through course assignments and gather feedback from instructors and students.

Context: The BRIDGES software provides capabilities for creating more engaging programming assignments, that includes 1) a simplified interface for accessing real-world data sets, such as social networks; scientific, government, and civic organization data; and movie, music, and literature collections; 2) interesting visualizations of the data generated by the students' own generated data structures/algorithms, 3) an easy to use interface to support creation of games, and, 4) algorithm benchmarking. At the same time, BRIDGES emphasizes rigor and standard learning outcomes, that are expected of early CS courses while providing an engaging learning experience.

Outcomes:

Instructors participating in using BRIDGES software in their classes were required to complete 3 assignments using the software. Students completed a project survey after each assignment. The feedback was analyzed and summary reports were provided to participating instructors.

Survey responses indicated that some investment of time was needed to use BRIDGES, but the extra efforts were associated with several notable outcomes, 1) students and instructors had positive perceptions of the value of engaging in BRIDGES projects, 2) students involved in BRIDGES projects demonstrated larger gains in knowledge of the data structure content compared to students enrolled in comparable course sections, as well as long-term benefits in their performance in four follow-on required courses. BRIDGES can thus become a tool to get students more engaged in critical foundational courses, demonstrating relevance and context to today's computational challenges.

Broader Impacts:

To date, BRIDGES has been used by over 2000 students across 20+ academic institutions, comprising universities, community colleges, 4 year colleges and high schools (in AP CS courses). The current effort has focused more on broader adoption of BRIDGES, and is yet to study demographic impact. Current efforts are focused on customizing BRIDGES materials to specific student groups, providing multiple options for choosing BRIDGES assignments, and studying their impact on each student group.