An Engaging CS1 Curriculum Using BRIDGES

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ABSTRACT

Early programming courses such as CS1 are an important time to capture the interest of students while imparting critical technical knowledge. Yet many CS1 courses are being taught using toy assignments and activities that tend to make students uninterested or doubt the usefulness of the content. In this poster, we demonstrate an enriching experience for students by coupling interesting datasets with visual representations and interactive applications, without having to change the content of that course. Our approach utilizes extensions to BRIDGES, an API in use for sophomore level CS courses for the past 5 years. BRIDGES provides easy access to external datasets and helps build interactive applications. The assignments we present are all scaffolded in a way that can be directly integrated into most early programming courses to make routine topics compelling and exciting.

KEYWORDS

real-world datasets, games, engagement

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1 PROBLEM

Enrollments in computing majors have grown significantly in recent years, however, high attrition rates remain a significant issue. A key factor influencing student motivation is their engagement with learning materials. Traditional approaches in early CS courses have been to teach basic programming constructs (loops, conditionals, objects) using toy datasets and command line input. More engaging and modern approaches generally involve socially or culturally relevant data, simple graphical libraries, and gamification of the material. All these features are prioritized in our work.

2 METHODS

BRIDGES[1] is a toolkit that we have developed and has been in use for the past 5 years, for improving retention of sophomore

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Table 1: CS1 Assignments Using BRIDGES

Assignment	CS1 Concepts	Engagement
Etch A Smile	2D Grids, loops	Visualization
Bugstomp	2D addressing, I/O	Interactive Game
Tic Tac Toe	Conditionals, 2D array	Interactive Game
Song Lyrics	2D grid processing, String parsing, conditionals	Real Lyrics data, visualizations
Image Processing	2D array processing, 1D, 2D addressing	External Data, Color models
	Memory allocation	Manipulating Images
Mountain Path	Loops, conditionals, 2D addressing, File input	Greedy algorithms, Real-world data, Visualizations

level CS students. The BRIDGES API facilitates highly engaging assignments using real world datasets and visualizations. Most of the effort to date has focused on data structures and algorithms courses, and has impacted nearly 1500 students across multiple institutions. Over the past year, we have added new features to BRIDGES that facilitates its use in early CS courses, such as CS1 and CS2, including a Game API, that makes it possible to implement a variety of 2D games.

3 RESULTS

We have built a number of BRIDGES assignments that are appropriate for CS1 courses. Table 1 illustrates these assignments and the CS1 topics/objectives that are addressed by each assignment. The BRIDGES assignments website[1] illustrates example assignments and visualizations. These assignments were used in a number of sophomore level courses and surveys used to get student feedback. Results of two questions in the survey, “The assignment increased my interest in computing”, “The assignment was relevant to my career goals” on the Mountain Path assignment showed positive feedback from students over two semesters.

4 CONCLUSIONS

Several of our BRIDGES users are currently testing these assignments in their early CS courses and collecting student feedback. Future work will involve building a full curriculum and performing a formal intervention in a CS1 course.

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