

Real-World Problems, Data, and Visualizations Using BRIDGES

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Agenda

- Introduction [15 min]
 - Presentations
 - What is BRIDGES and how does it help?
- A First Example - Graph Tutorial [10 min]
- Activity: Interactive and Visual [Play with BRIDGES Tutorials] [10 min]
- Making it Real : A Tour of BRIDGES [15 min]
- Making it Real : Experiences from a Long Time BRIDGES User [15 min]
- Activity: Small Group Discussions [15 min]
- Workshop Survey, Opportunity to Participate [5 min]

Introductions

- Who are we?
- Who are you?

BRIDGES to Improve CS Education through Engagement

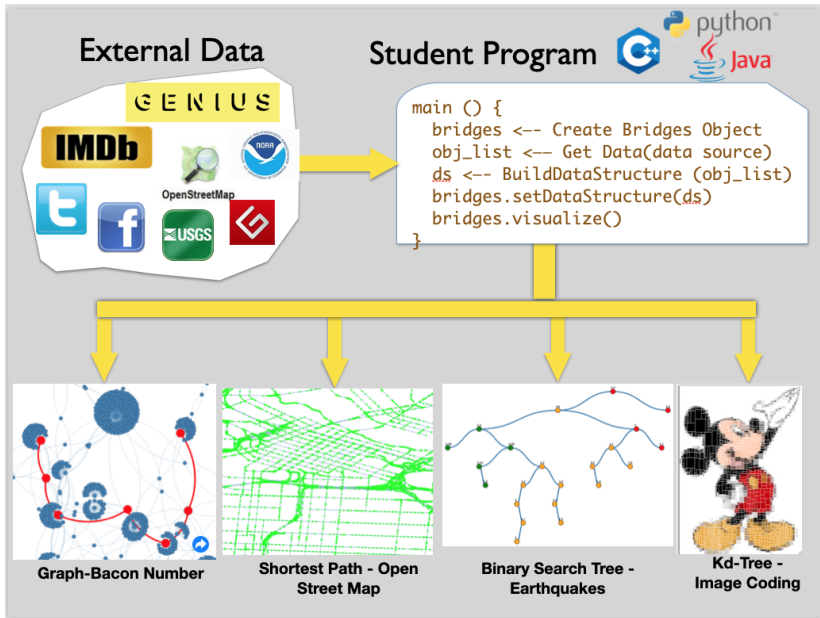
Motivation

Attrition rates in early foundational courses are high (40-60%), need to improve student engagement, and demonstrate the potential of Computer Science to incoming freshmen/sophomore students

BRIDGES' approach

- Bring **real-world datasets** into the classroom.
- **Visualizations** of *student generated* data structures, interactions, algorithm performance/complexity.
- Student output shared (with friends, family) via **web link**

BRIDGES provides engaging Input and Output

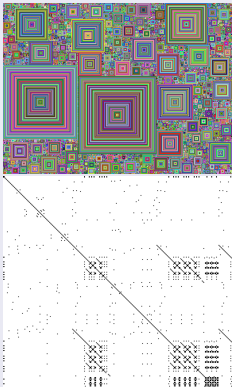


BRIDGES in CS1/CS2 Courses

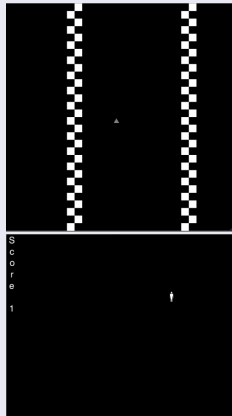
What is difficult in a CS1 course?

- Hello World is BOOOOOOOORING...
- We added two arrays of integers, I am soooo impressed...

Graphical Patterns and Analysis



Games

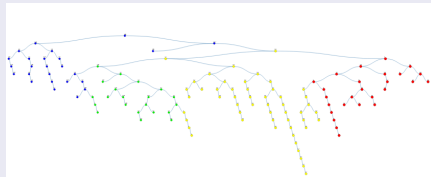


BRIDGES in Data Structures Courses

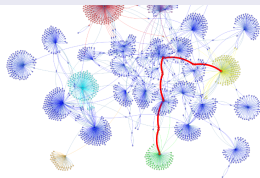
What is hard in a Data Structure course?

- Debugging is haaaard.
- I don't understand what the data structure looks like!
- **Does any of this matter in the real world?**
- Two examples below: Binary Search Tree with USGS earthquake Tweet data, Bacon Number problem with IMDB Data (BFS algorithm)

Indexing USGS Earthquake



Bacon Number [IMDB Data]

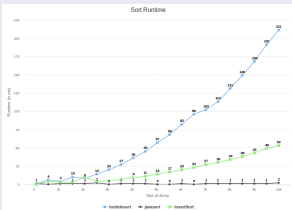


BRIDGES in Algorithms Course

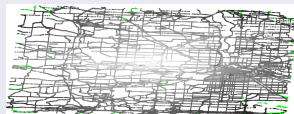
What is difficult in an Algorithm class?

- Complexity is confusing!
- I am never going to use any of these crazy things.
- Why is he still talking about complexity?
- BRIDGES provides **benchmarking** features and large datasets, so as to demonstrate algorithm performance.

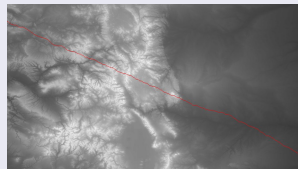
Sorting Benchmark



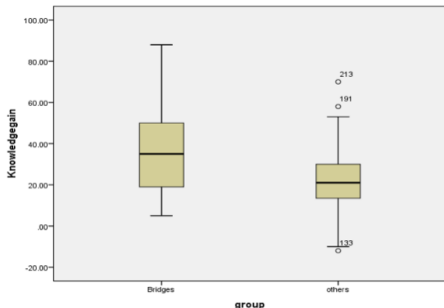
Shortest Path (OSM)



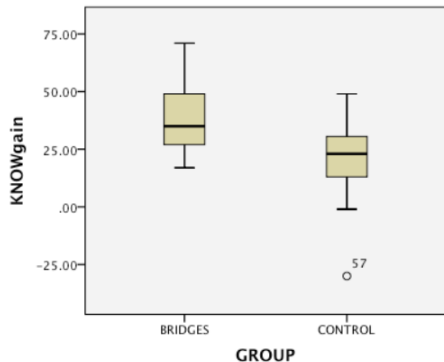
Mountain Path (DP)



Students in BRIDGES sections gained more knowledge



Fall 2014



Spring 2015

Students in BRIDGES sections performed better in follow on core CS

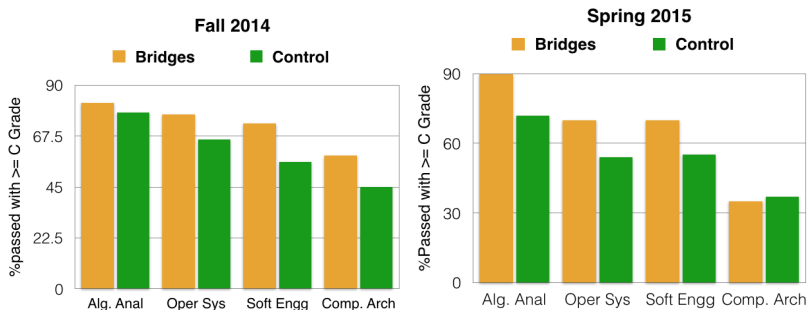
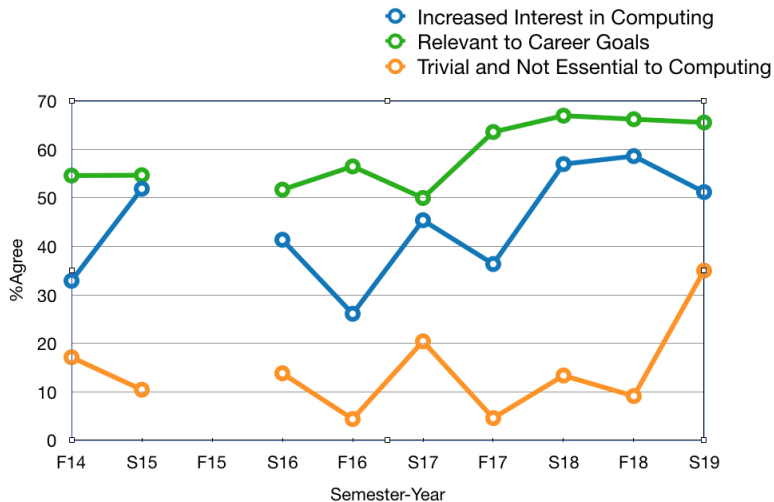


Figure: Comparing long-term student achievement between students who used the BRIDGES toolkit in the Data Structures course vs. Control group. The evaluation was performed with 2 cohorts of students (Fall 14, Spring 15). Analysis performed Spring 2019.

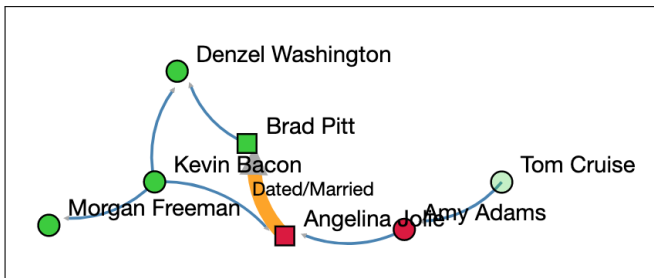
Students using BRIDGES appreciate CS better



Reference: [D. Burlinson et al., BRIDGES: Real world data, assignments and visualizationsto engage and motivate CS majors to engage and motivate CS majors, Education and Information Technologies, 2023](#)

A First Example - Graph Tutorial

- You can click on the figure below to take you to the tutorial.



Activity : Real, Interactive and Visual [10 min]

- Look at other BRIDGES tutorials in your favorite programming language (C++, Java or Python).

A Tour of BRIDGES[15 min]

The BRIDGES Assignment repository

- A collection of assignments with descriptions, starter code, expected output solutions (provided on request by instructor)
- Repository [Link](#)

Activity

- **To Do:** Look through the assignments that attract your interest and look at its related materials
- **To Do:** Find assignments that would work for you in your class.

Experiences from a Long Time BRIDGES User [15 min]

Discussion [15 min]

Possible Discussion Topics

- What issues do you face in teaching (early CS) courses?
- Can tools like BRIDGES be helpful? What are the hurdles?
- What do you do to engage today's students?

Adopting BRIDGES

Why?

- Well tested: over 2500+ students, 8000+ BRIDGES projects, 20+ institutions
- Increased engagement
- A growing set of pre-designed assignments
- Full Support from the BRIDGES team
- Stipends available for adopters

How to adopt? Contact us!

- esaule@uncc.edu
- krs@uncc.edu

Support

This material is based upon support from NSF DUE-1726809, 2142381.

BRIDGES Participation - Opportunity

- BRIDGES under active development - funded by an NSF IUSE grants - **to disseminate BRIDGES to external users!**
- Need help in **adopting, contributing, and extending** BRIDGES.
- Build **engaging assignments** and data sources that also reinforce CS rigor.
- Use BRIDGES in the classroom, collect data and provide feedback; all evaluation materials provided through online Qualtrix surveys by project evaluator.
- **Stipends** available for instructor; alternately **TA support** can be provided.
- Full technical support provided, and interaction with Bridges team/community, monthly user meetings.
- We plan to hold **3-day summer workshops on BRIDGES** in 2026.

BRIDGES Workshop Survey (5 min)

BRIDGES Workshop Survey