

How BRIDGES can help with Engagement

Kalpathi Subramanian¹, Erik Saule¹, Jamie Payton², and Matthew Mcquaigue¹
krs@uncc.edu, esaule@uncc.edu, payton@temple.edu, mmcquaig@uncc.edu

¹The University of North Carolina at Charlotte

²Temple University

BRIDGES Workshop, May 23-25, 2022

Table of Contents

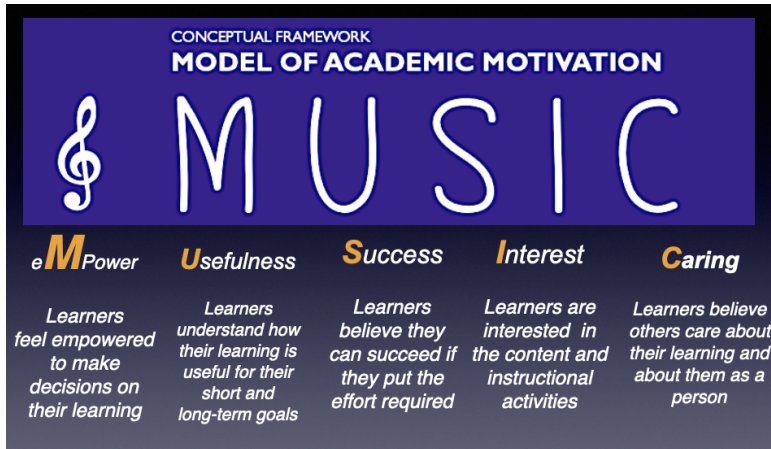
- 1 Relevant and engaging content
 - What makes a course engaging?
 - Making it interactive/visual
 - Making it real!
 - The power of choice

Engagement and Motivation

- Well understood that student engagement is an important predictor of student achievement.
- Engagement can span many dimensions¹:
 - skills engagement
 - participation/interaction engagement
 - emotional engagement
 - performance engagement
- Engagement and motivation are closely tied to each other
- How do we motivate and engage students? Many models have been proposed, such as the MUSIC model of motivation (Jones, 2009)

¹Handelsman et al., A Measure of College Student Course Engagement, Journal of Educ. Res., 2005

The MUSIC Model of Engagement ²



²Jones, B.D, Motivating Students to Engage in Learning: The MUSIC Model of Academic Motivation, Intl. Journal of Teaching and Learning in Higher Ed., 2009

Engaging Students: Experiences from an OOP Course ³

Two semesters of a project based OOP course, using student reflections after each course module

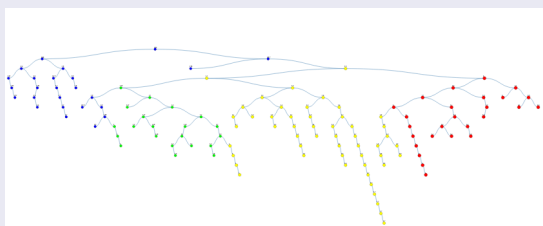
- **eM**powerment: Project choice, freedom to be creative, experimentation and tinkering
- **U**sefulness: Working with real-world data/tools, team environment
- **S**uccess: Assignments with clear instructions, predictability, reflect on personal successes/failures, feedback
- **I**nterest: Fun factor, games, real world images used as part of course
- **C**aring: Sensitive to student needs, prompt feedback, deadline flexibility

³Subramanian et al., Influence of Course Design on Student Engagement and Motivation in an Online Course, ACM SIGCSE 2020

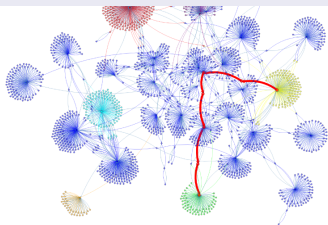
Engagement Using BRIDGES: Visual and Interactive

- BRIDGES uses visualizations of data structures, algorithm outputs as a mechanism for engaging students.
- Visualizations of classic CS concepts can be helpful in making them real and more meaningful.
- Student feedback is very positive, appreciating the features of BRIDGES that enables them to see what they produce.

Indexing USGS Earthquake



Bacon Number [IMDB Data]



- Interactive applications is a more attractive approach to experimentation - changing parameters to see its effect on a phenomenon, solution, performance.

Activity

- Review BRIDGES tutorials

Make it Real!

- Using **real-world data** in course work is an important engagement tool
- Students respond to working with data from real-world scenarios; appreciate the use of images, maps, games
- Data is everywhere, the harder part is
 - Accessing data in a ready-to-use form for course work
 - Mapping the right data to course work to meet objectives.
- Example: A BRIDGES example for retrieving Earthquake records

```
// create Bridges object
// command line args provide credentials and server to test on
Bridges bridges (atoi(argv[1]), argv[2], argv[3]);
if (argc > 4)
    bridges.setServer(argv[4]);
// set title
bridges.setTitle("Accessing USGIS Earthquake Data (USGIS Data)");

// read the earth quake data
DataSource ds (&bridges);
vector<EarthquakeUSGS> eq_list = ds.getEarthquakeUSGSData(max_quakes);

// print the first quake record
```

Activity: BRIDGES Data Access and Assignments that use real-world data and Visualizations

- Accessing Earthquake Data
- Bacon Number Computation (Graph BFS)
- OpenStreet Map (Graphs - Shortest Path)
- Image Representation/Compression (Spatial Search Trees - Kd-Tree)
- Algorithm Benchmarking - Comparing Sorting Algorithms

The Power of Choice

Providing choices in learning materials (lectures, assignments, etc.) provides flexibility and choice for students as they might have different preferences/interests

- Challenge: Designing multiple versions of learning materials that meet the same learning objectives involves a higher load on instructors
- Examples:
 - Assignments that can use different real-world datasets
 - Different assignments that rely on the same underlying algorithm
 - Lecture slides that explain the same concept in different ways.
- Choice in learning materials has shown in prior work being appreciated by students.

Activity

- Group 1 (Different datasets):
 - Linked list using IMDB data
 - Linked list using USGS Earthquake data
- Group 2 (Different assignments, same algorithm)
 - Bacon Number (Graph - BFS)
 - Maze Solution (2D array - BFS)