How BRIDGES can help with Engagement

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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?
- What engagement strategies can we use?

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

Engagement Strategies

• Active Learning:

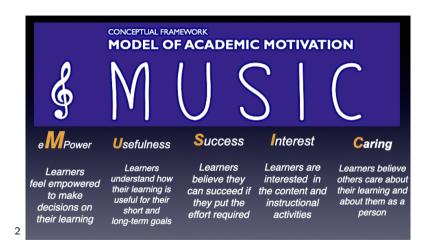
- Pair Programming
- Flipped classroom
- Group work/collaboration/Light Weight Teams
- Quizzes

Content Based

- Real world data integrated into curriculum, demonstrate relevance
- Align with student interests, values, social relevance

BRIDGES focuses on content based engagement

The MUSIC Model of Engagement



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

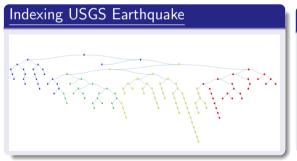
Engaging Students: Experiences from an online OOP Course ³

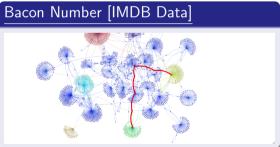
Two semesters of an online project based OOP course, using student reflections after each course module

- Visible Rythmic Structure. Visual map of modules that follow a rythmic structure with milestones for preparation, problem definition, solving, testing and reflection
- **Design before Coding.** Explicit requirements to get students to turn a project design (flow charts, diagram, pseudocode) prior to implementation lets students spend time thinking through the solution prior to coding.
- Transparent Expectations and Instructions: Clear course goals, assignment descriptions/purpose, expectations, rubrics and expected output, presented in writing.
- Real World Projects, Tools, Data. Careful selection and Use of engaging projects that use real world applications and data and tools and technologies.
- Happy Challenges: Challenged to think, encourage creativity and allow for flexibility/choice in activities. Students feel challenged, but also very satisfied to 'figure it out'
- Sustained Reflection. Reflection points after each module helped students communicate their personal success/failure/venting and how/what they are learning;

Engagement Using BRIDGES: Visual and Interactive

- BRIDGES generates **visualizations** of data structures (**that students implement!**), 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 has been very positive, appreciating the features of BRIDGES that enables them to see what they code and produce.

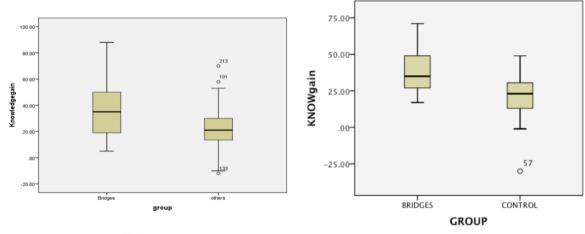




Engagement Using BRIDGES: Use Real-World Data

- Using real-world data in course work is an important engagement tool
- Students respond to working with data from real-world scenarios/data: weather/climate, maps, medical, census, books, music, videos, 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.
- BRIDGES supports a number of datasets ready to use in early CS courses:
 - Earthquake Data:
 - $\textit{List} < \textit{EarthquakeUSGS} > \textit{eq_list} = \textit{bridges.getDataSource()}.\textit{getEarthquakeUSGSData(100)}$
 - IMDB Actor-Movie Data: List<ActorMovieIMDB>am_list = bridges.getDataSource().getActorMovieIMDBData(1813)
 - Open-Street Map Data:
 OsmData osm_data = bridges.getDataSource().getOsmData("Charlotte, North Carolina", "default")

Results: Students in BRIDGES sections gained more knowledge



Fall 2014

Spring 2015

Results: Students in BRIDGES sections progressed faster in CS

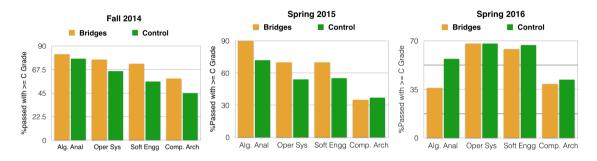


Figure: Comparing long-term student achievement between students who used the BRIDGES toolkit in the Data Structures course vs. Control group. The evaluation was performed with 3 cohorts of students (Fall 14, Spring 15, Spring 16).

Analysis performed Spring 2019.