

BEEC Share and Learn Report: December 2023

Presenters: Ali Ansari, University of Illinois Urbana-Champaign

Topic: Adventures in Game Based Learning Implementation in Bioengineering Curricula

Resources:

All Games Dr. Ansari has developed: <https://drive.google.com/drive/folders/1JhrCQpUs4jiirDacOi5oApgrWAVn9RVJ>

Email to be able to use: aansari2@illinois.edu

Prodigy, K-6 Math Games: <https://www.prodigygame.com/main-en/>

A How to Guide and Template for Designing a Puzzle Based Escape Room Game:
https://qubeshub.org/community/groups/coursesource/publications?id=2868&tab_active=about&v=1

Presentations Overview:

- Introduction/Why:
 - Has taught across a multitude of disciplines and classes. A lot of what he has observed is that there is a fear barrier that core materials need to feel more confident and help with issues of retention especially minoritized populations
 - Tries to make classroom places where students can frame knowledge they gain as tool, and tries to make it absurd
- Game-based Learning vs. Gamification:
 - Gamification: building an entire framework in which you put everything else into
 - Build entire course into a game and other things are going in there. And then at the end you assess it overall
 - Game-Based Learning: building a small module or game and houses the assessment itself
 - Build a game and allow them to learn a concept (e.g. Fourier Transform) and then use it to assess
 - Assessment IS the game in game-based learning, unlike in gamification
 - Game based learning is the application of game based elements using games (e.g. puzzles) to increase engagement and retention. Game is the vehicle of delivering the learning objective
 - Gamification – allows you to level up with prizes and collectibles to reach a goal such as a leaderboard. This allows you to create a competitive environment
- How Did I Do It?
 - Two main implementations:
 - Lecture Integration - harder
 - Lab Based Integration – easier because you can easily change how you demonstrate something
 - Lecture Integration
 - Cost of using games: time, especially in core courses
 - Cover material on two days and last day do a puzzle
 - Class competition where given quiz that covers what they learned over week and in addition something they haven't seen before. Use things they have seen in their lives (e.g. computer circuit, what is each part, what do you think it does, go from simple to complex: alarm, CPAP machine, refrigerator)
 - End with think-pair share that has an open-ended question
 - Issue: does not scale well with classes 60+
 - Example: each group a part of a control system (plant, controller, feedback loop), issue – took longer to explain (15 min) and those who didn't understand game concept in first place didn't benefit from it

- Example: dovetails into student led journal clubs – students talk about how papers intersect and what they mean contextually. Evolved into “dueling journal club”
- Lab Integration
 - Matlab based puzzle labs
 - Trying to make Matlab less intimidating and make rote parts of coding more bearable
 - Made a murder mystery: wrote a lab and they had to solve Matlab riddles and apply (e.g. conditional statement) to solve murder mystery
 - Lab forced students to use formative things they did in previous labs to solve puzzles (e.g. use a filter to remove white noise)
 - Other lab; Uno Reverse Card – students have to create their own puzzles from course materials and have one student in lab section complete the lab
 - After class surveys shows that they doubled in confidence in being able to use Matlab coding
 - Probability course: M&Ms to explain chi squared error and how distributions may differ from the models they have learns
 - Signals and Systems course: record parts of songs and analyze in matlab and draw pictures based on laplace transforms
- Limitations of Game based learning
 - Building games is hard. It takes instructors a lot of time figuring out how you want to frame game and what you want to assess
 - Games will run away from you and may take away from the material you are trying to assess. It can take away from the “spotlight”. Sometimes simpler is better
 - Large classes makes games so much harder. Designing games for 5-15 people is way different from 60+ students
 - Need to take into account diversity of the population that they are built for. There is no “one size fits all” for games. You can’t retrofit them across classes and materials – some may find it a hassle because of difficulty things like word games are confusing for non-native speakers
 - Games require buy in from students – if they don’t find it interesting they will not be able to learn it in 15 minutes and will not want to do it in 15 minutes
 - You are a human and coming up with novel, engaging and relevant for everything is impossible, so you should pick and choose when you want to do this
- Successes
 - Games can help build confidence and allow students to play, which can be powerful motivators
 - You can make abominations in Matlab to make intimidating concepts can be broken down, mocked and humbled. You can make them do these things to show that they are just a tool
 - You can allow students to understand a little better how much they understand. If they start with a crossword puzzle or word search, they can tie this together and build upon it
 - Allows them to be able to remember it, tie it back
- How to Build Your Own Games
 - 1) Decide on a topic – what is worth focusing on, e.g. Fourier Series
 - 2) What are the learning objectives for this? What do you want them to master? E.g. perform an FFT and recognize how that relates to music. Analyze frequency and transform that into music
 - 3) What is the game that you want them to play? What is the MEDIUM? E.g. use Matlab to convert frequencies into sound and create a virtual piano keyboard.
 - 4) What are the ways you visualize this? How can they play with this and make it theirs? (Alignment) – e.g. we have them record their favorite song on their phone and analyze it
 - 5) How do you assess it? E.g. have them write down the notes in their favorite songs as well as the frequencies in it. And perform a small clip for us.
 - If you noticed, this is the same thing that you already do when you lecture prep.
- Examples of my stuff

- See: <https://drive.google.com/drive/folders/1JhrCQpUs4jiirDacOi5oApgrWAVn9RVJ>
- Email to be able to use: aansari2@illinois.edu

Open Discussion:

Scott Wood: Thoughts on crossword one day, sudoku other day, versus something that builds over time. For example, incorporating a DND style game or murder mystery where it strings out over the course of the semester?

Depends on style – would need to be cool to build serial drama and maybe build up engagement

Scott Wood: how do you think the students would respond to it? Would they feel scattered?

If you did it every week (puzzles Friday) then they could look forward to every week and build engagement and excitement to come to class. But you have to remember to do it each week.

Taylor Williams: have you come across any tools (e.g. Prodigy) that has a role playing game to do math problems for other things that are already built? Time and building these games are difficult and take too much time, especially if you are teaching a lot.

<https://www.prodigygame.com/main-en/>

Mathblaster and Midnight Rescue for Math Games (Edutainment) – once you figure out what you can cobble together quickly you can then make it more efficient in other classes

You can use crossword makers and word search makers and once you know how to integrate it it's easier – don't use Matlab for everything!

Scott Wood: what are your thoughts how to use “prompt engineering” and generative AI to be able to learn how to use these tools to build their own systems?

Taylor: By the time they graduate they will become every day tools and learn how to use them as tools and how to cite them

Ali: being able to use generative AI to build the games can be a cool concept and be used as a tool to show them how to jump the learning curve of things like how to code in matlab

John Foo: Ashley J. Earle – A How to Guide and Template for Designing a Puzzle Based Escape Room Game:

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