Improving Student Engagement & Self-Assessment Through "Gamification"

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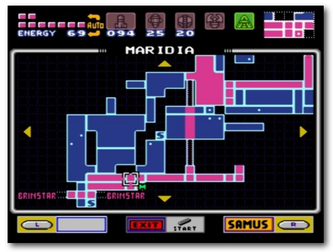
The problem: CPSC 221: Data Structures & Algorithms is a content-heavy course that spans multiple, core concepts at multiple levels of abstraction. Students often have difficulty "keeping up" and poor self-estimates of their own performance.

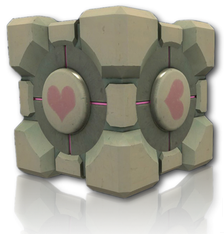
Within the course the **road to mastery** is characterized by **two broad tiers**:



Metroid map: pink areas have been explored by the player.

1. **Basic mastery** of each data structure and algorithm both in abstract and concrete (implementation).

2. **Unconscious competence** of the information at tier one and ability to operate on the more abstract level, choosing appropriate data structures and algorithms in the context of problem solving and deeper analysis.



Routinely students fail to master one or more core concepts at the first level and **so fail to absorb the more advanced, abstract concepts and connections.** This leads to frustration and poor course outcomes.

How can we improve mastery of low level concepts while helping students improve their self-assessment?

"Gamification" is the study of the underlying motivational psychology of (video) games and the application to other domains.

Zynga's FarmVille has a simple mechanic and yet is intensely popular on Facebook

Why? Video games frequently have a large learned component and highly committed players who complete "mundane", repetitive tasks for seemingly little reward...*while having fun.*

Research* suggests several factors at work in effective games that are relevant to education more broadly. For example:

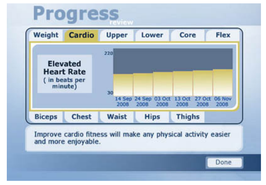
Age of Empires: provides clear objectives and tracks their completion

1. *Frequent progress updates, such as % of map revealed, objectives met, experience points needed for next level, etc.*
2. *Small, achievable, and immediately relevant goals and subgoals.*
3. *Meaningful and immediate reward/punishment system.*
4. *Balance between challenge and boredom*
5. *Simple, guided advancement through increasingly difficult content-- as the player improves, the content increases in difficulty.*
6. *Ways to tailor difficulty, such as tutorial levels and limited access to content and abilities.*

*Complete references available on request.

We apply these six factors to provide students with a corpus of activities **synced with course learning goals**. On reaching certain thresholds students can **unlock other activities** and content. Further, students and faculty have access to an interactive **display showing relative progress through the course** and performance on various course activities. Students will be able to view the revealed concept map showing dependencies. Faculty can also view overall student performance across course.

In Dragon Age players can track their progress toward the next level



Example progress report from My Fitness Coach for the Wii

Measurement & Results: Efficacy of the system will be measured via naturally occurring data and an expert-behaviour inventory pre/post survey. Anecdotal and focus group data will also be collected.

Valve's Portal series is a very simple puzzle-based seiries with increasing difficulty & complexity of in-game tools

Current work includes the completion of baseline data collection, and implementation of the first version of the system this summer.