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:

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.

Routine 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.

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:

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.

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.

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.

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.

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

*Complete references available on request.