Low-stakes assessment in the high structure active learning classroom: a juggling act

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Outline

• What I teach and the inherent necessity for using frequent assessments
• Define low-stakes assessment in context
• Benefits of using low-stakes assessments
• My toolbox (ALEKS, Sapling, and i>clicker 2)
• Challenges
• Effect on students’ attitudes toward course
• Efficacy
Learning chemistry requires lots of practice

• General Descriptive Chemistry I (CHEM 101)
  • A heavily problem-based discipline
  • Relentlessly cumulative by nature
  • 220+ students per section (do not all come in with the same knowledge state)

• Low-stakes assessments necessary to monitor progress (if you care about that sort of thing)
  • Students need practice and feedback
  • Timely handwritten practice and manual feedback is impossible with current volume of students
High-stakes vs. Low-stakes assessments

**High-stakes assessment**
- Summative
- One to three assessments used to determine letter grade
- Examples:
  - Midterms
  - Finals
  - Term papers

**Low-stakes assessment**
- Summative and Formative
- Several assignments used to evaluate student learning and adjust teaching as course progresses
- Examples:
  - Reading quizzes
  - Adaptive learning/mastery systems
  - In-class audience response systems
  - Online self-practice systems
Benefits of using low-stakes assessments

• Students spend more time developing thoughts and ideas about a concept (before class, during class, and after class)
  • They ask good questions

• Can practice solving more challenging problems in the classroom

• Exposes misconceptions in real time
  • I know what they don’t understand

• Allows me to adjust course quickly
My toolbox (ALEKS, Sapling, and i>clicker 2)

• ALEKS – adaptive learning mastery system
  • currently only using as pre-course prep

• Sapling – practice problem system with precise feedback
  • Weekly pre-class warm-up
  • End-of-week self-assessment/practice

• i>clicker 2 – audience response system
  • Daily quiz
  • Participation

• Altogether accounts for ~18% of a student’s grade
Challenges

• Can be time-consuming to setup and manage (depending on vendor, tech support staff can take on brunt of course setup and management)

• Requires significant forethought into course layout and objectives

• Technical difficulties and lots of student emails/questions

• Costs money (defrayed by use of a free open source text book)
Outcomes – Students’ attitudes and satisfaction

• Students are engaged with course

• Rarely ever asleep or doing something distracting

• Ask good questions

• Improved self-efficacy

• Dislike all the work but see the benefit in the end
Outcomes – Students who did their homework did better on the final exam (Spring 2015)

Online Prep and HW Avg. vs. Final Exam Score (1-pt moving avg.)

$R^2 = 0.53008$
What I teach and the inherent necessity of formative and summative assessment

- CHEM101-General Descriptive Chemistry I
  - A heavily problem-based discipline
  - The only way to be good at solving chemistry problems is by solving chemistry problems
  - Reading, watching videos, listening to lectures help somewhat
  - Contact with real problem-solving is the most useful learning tool
  - With 300+ students per section, assigning and checking a sufficient number of hand-written practice problems in a timely manner is impossible
  - Yet students need practice and feedback to really make substantial learning gains
  - Practice can be facilitated through low-stakes assessments in and out of class to maximize student contact hours with skills development

What is a low-stakes assessment?

- Compare high-stakes to low-stakes
  - High-stakes assessments: e.g., a few midterms and a final
  - A zero grade (the most important thing in the whole world) is tied to a few large caches of points that can cover a wide breadth of topics
  - Low-stakes assessments provide more practice and contact with material
  - Online prep systems (like ALEKS) encourage mastery of basic topics so that class can be richer
  - Reading held accountable with brief quizzes
  - In-class audience response systems (clickers, or poll everywhere) to assess understanding in real-time
  - Online HW systems (ala Sapling, ALEKS, etc.)

Why do I use them?

- Students get to spend more time developing thoughts and ideas about a concept (before class, during class, and after class)
- Practice application of skills through solving challenging problems can happen in the classroom where students can get help from the expert (me)
- Exposes misconceptions in real time (sometimes students have no idea how to approach thinking about a problem...I can intervene)
- I know what they don’t understand (remarkable feat for 200 students)
- Allows me to think about why they don’t understand certain things and not just what it is they don’t get

Which ones do I use and how do I manage them?

- Have used ALEKS for warm-up/mastery (works great), but now use as pre-course prep
- Using Sapling for pre-class warm-up (weekly) and for end of week homework/self-assessment/practice
- i>clicker 2 remote system for in-class responses (at least 80% correct responses >90% of the time)

Hurdles/obstacles

- Can be time-consuming to setup and manage (depending on vendor, tech support staff can take on brunt of course setup and management)
- Requires significant forethought into course layout and objectives
- Technical difficulties and lots of student emails/questions
- Costs money (defrayed by use of a free open source text book)

How do they affect students’ attitudes toward course?

- Students are engaged with course and are rarely ever as sleep or doing something distracting

Are they effective?

- Students who participate and do their homework do well on the final exam
A typical day in my class

• Prep:
  • Do critical thinking questions and read or watch videos to help

• In-class:
  • Quiz on 1-3 random CTQs (no more than 10 min total)
  • Brief 5-10 min lecture on topic
  • 5-10 min review of CTQs in groups (lecture as needed)
  • Rest of time
    • At least two exercises/problems
    • One-two exam-level questions
Facilitation in a large format class

• Assign groups
  • Hold group members accountable to each other (peer evaluation)

• Structure your time carefully
  • Students usually take longer than you think they will

• Try to get help!
  • Use in-class mentors to help facilitate

• Use clickers (or some type of audience response) to assess progress/understanding

• DO NOT leave the students hanging
High structure active learning classroom

• Juggling between
  • Pre-lecture activities (assessment via online warmups in Sapling)
  • Lecture (assessment via clickers)
    • Group activities
    • Actual lecture
  • Post-lecture assessment (assessment via online homework in Sapling)