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.)

$R^2 = 0.53008$
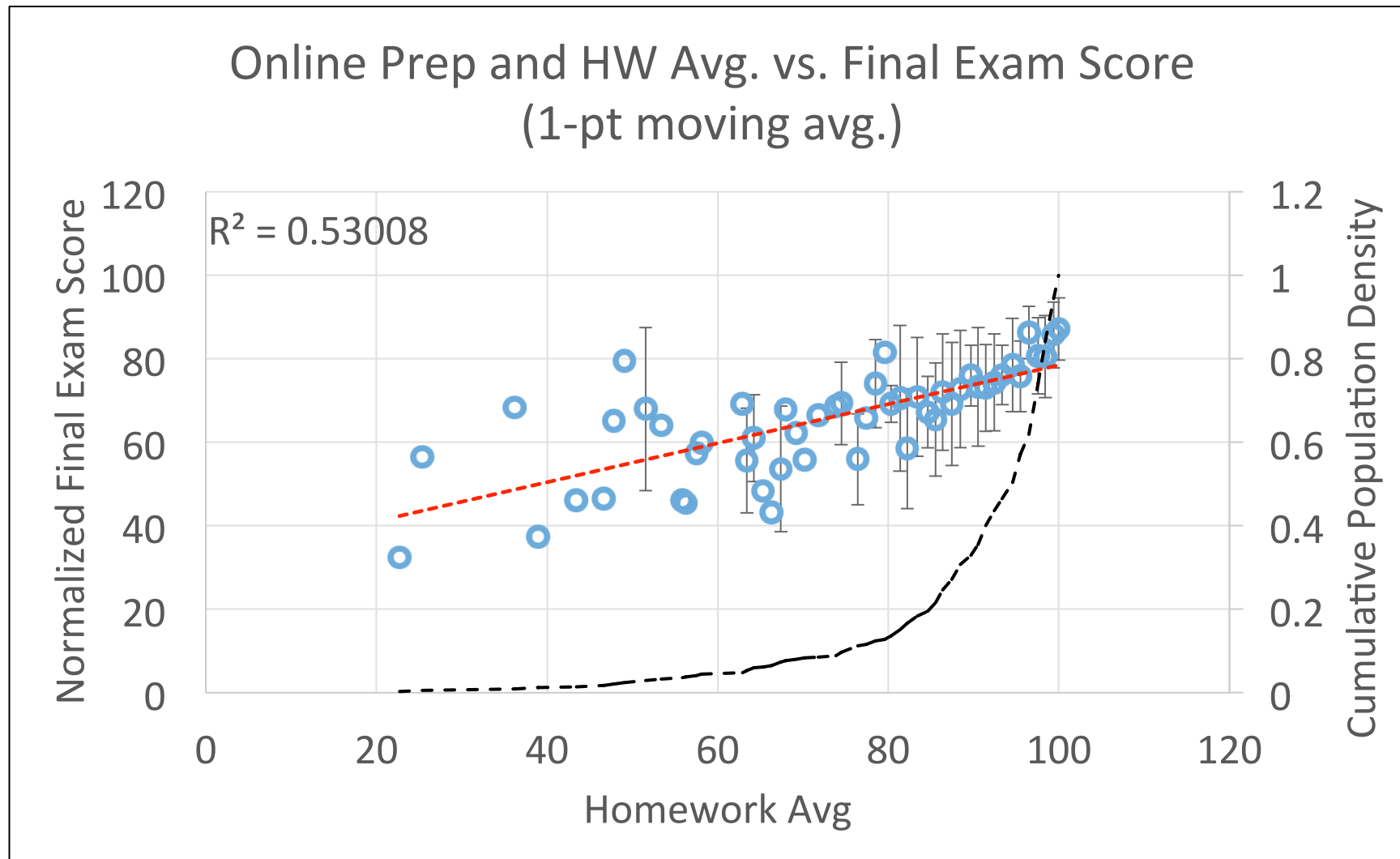
Outline

- 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 220+ students per section, assigning and checking a sufficient number of handwritten 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 letter 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)

- Hurtles/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 asleep 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)