STANDARDS-BASED GRADING IN MATH AND BEYOND

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@mathzorro  #sbg  #MasteryGrading #edchat
Life Before Standards

- Material to cover
- Teach it well
- How do I assess their learning?
- Choose concepts to test
- Partial credit: Worth 5 points? 7?
- What corresponds to an A?
- Final grade: Average exam grades.

“What should I study?”

“STUDY IT ALL”
My issues

- Exams are high stakes
- Focus on grades, NOT learning
- Grades don’t align with mastery
- We assess only what is testable
- Exams gauge understanding at a fixed point in time
- Opaqueness of the whole system

Is a B:

- Fair understanding of most material?
- Excellent understanding of some material?
My Standards-Based Grading

- Transparent list of standards
- Assessments of 3-4 standards every 2-3 weeks
- Each standard scored for mastery
  - 4: Completely correct 3: Almost correct with most main ideas
  - 2: Some main ideas; not complete 1: Very partial solution 0: Weak Start
- Reassessments to improve score (2 per week)
- Grade based on mastery of standards:
  - A: 90% 3.5+, others 3+
  - B: 80% 3+, others 2.5+
  - C: 80% 2+, others 1.5+
  - F: less than 80% 2+
Examples of Standards

- **Basic Integrals. (core)**
  Can you *evaluate* standard antiderivatives, definite integrals, and indefinite integrals involving polynomials? Involving trigonometric functions?

- **Area between curves.**
  Can you set up and evaluate an integral with respect to $x$? $y$? Can you *convert* between the two? This involves determining the correct bounds of integration.

- **Key Theorems.**
  Can you *state and apply* the Fundamental Theorem of Calculus, parts I and II? Mean Value Theorem for Integrals? Do you understand their interpretations?

- **Mathematical Experience.**
  Can you approach problems in multiple ways? Are you *willing to make mistakes*? Can you learn from your mistakes? Are you able to *discuss mathematical concepts* with your classmates?

- **Project Management.**
  Can you *work together* on your project as a group? Can you follow project instructions? Can you work within a given timeframe and *meet deadlines*?
What I Love About Standards

- Focus is on the learning
- Growth mindset – “How do I improve?”
  - More one-on-one contact & just-in-time teaching
- Transparency in Grading
- Assessments not as stressful
- Higher expectations for students
Grade Sheet Example - Gradesly

<table>
<thead>
<tr>
<th>Assignment Name</th>
<th>Your Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Score for Standard 1</td>
<td>999</td>
</tr>
<tr>
<td>Current Score for Standard 2</td>
<td>4</td>
</tr>
<tr>
<td>Current Score for Standard 3</td>
<td>2</td>
</tr>
<tr>
<td>Current Score for Standard 4</td>
<td>3</td>
</tr>
<tr>
<td>Current Score for Standard 5</td>
<td>1</td>
</tr>
<tr>
<td>Current Score for Standard 6</td>
<td>2</td>
</tr>
</tbody>
</table>

For an A you need 90% of your scores >= 3.5 and no scores under 3

For a B you need 80% of your scores >= 3 and no scores under 2

For a C you need 80% of your scores >= 2 and no scores under 1

You have this many scores less than 3.5: 4
You have this many scores less than 3: 3
You have this many scores less than 2: 1
You have this many scores less than 1: 0

--- Raw Score for Assessment 1 -----
A1S1: Assessment 1, Standard 1 0
A1S2: Assessment 1, Standard 2 2

--- Raw Scores for Assessment 2 -----
A2S3: Assessment 2, Standard 3 1
A2S4: Assessment 2, Standard 4 1

--- Raw Scores for Assessment 3 -----
A3S5: Assessment 3, Standard 5 2
A3S6: Assessment 3, Standard 6 4

--- Scores for Any Reassessments Taken Below -----
S1R1: Standard 1 Reassessment 1 4
S1R2: Standard 1 Reassessment 2 999
S2R1: Standard 2 Reassessment 1 999
S2R2: Standard 2 Reassessment 2 999
S3R1: Standard 3 Reassessment 1 3
S3R2: Standard 3 Reassessment 2 999
Challenges with SBG

- Extra start-up costs: Multiple questions per standard
- Extra work from tabulation
- Extra work from reassessments
- Doesn’t scale well – Automate?
- Questions spanning multiple standards?
- Higher expectations for students
- Students are working – Scheduling constraints?
Student Feedback

- “I like knowing what I should learn from each topic”
- “SBG lets the student control their grade.”
- “It helped me to understand each topic more thoroughly.”
- “Grading scheme made me go back over where I was weak.”
- “I wouldn’t have bothered to study this concept.”
- “I’ve never been so excited to “get” a math concept.”
- “YES! I finally got it!”
Course Projects

- Projects = Active Learning

- Math Modeling: Simulate real-world scenario using Python
  - Bikeshare  • Population Growth  • Infectious Diseases

- Math Programming: Learn Mathematica and program:
  - Tutorial  • Mathematical Art  • Interactive App

- Combinatorics: Find real world situations / objects to count

- Integral Calculus: The Goblet Project
Project Deliverables

- Papers (Summary / Reflection)
  - Revision Process
- Programming Notebooks
- Presentations
- Posters
- 3D Printed Artwork / Exhibit
- Podcasts

How to grade?
Grading, Before and After

(5) Format Specifications
(10) Organization
(10) Grammar + Sent. Struct
(5) Abstract
(10) Background
(15) Model
(15) Results
(20) Discussion
(5) Appendices
(5) Bib. / References

Add up the points to get a weighted average.

Standards List

- Timeliness
- Writing Style
- Abstract
- Introduction
- Methodology
- Results
- Analysis
- Conclusions
- Python Notebook

Score each standard:

- 4: Truly exceptional
- 3: Exceeds expectations
- 2: Meets expectations
- 1: Minimally Acceptable
- 0: Unacceptable

Grade based on scores:

- A+ 4 on 3 stds, others 3+
- A 3 on 6 stds, others 2+
- B 3 on 2 stds, 2 on 7 stds, no 0’s
- C 2 on 4 stds, at most 1 0
- D at most one 0
- F at least two 0’s
Thank you!

- Robert Talbert
- Kate Owens
- My students