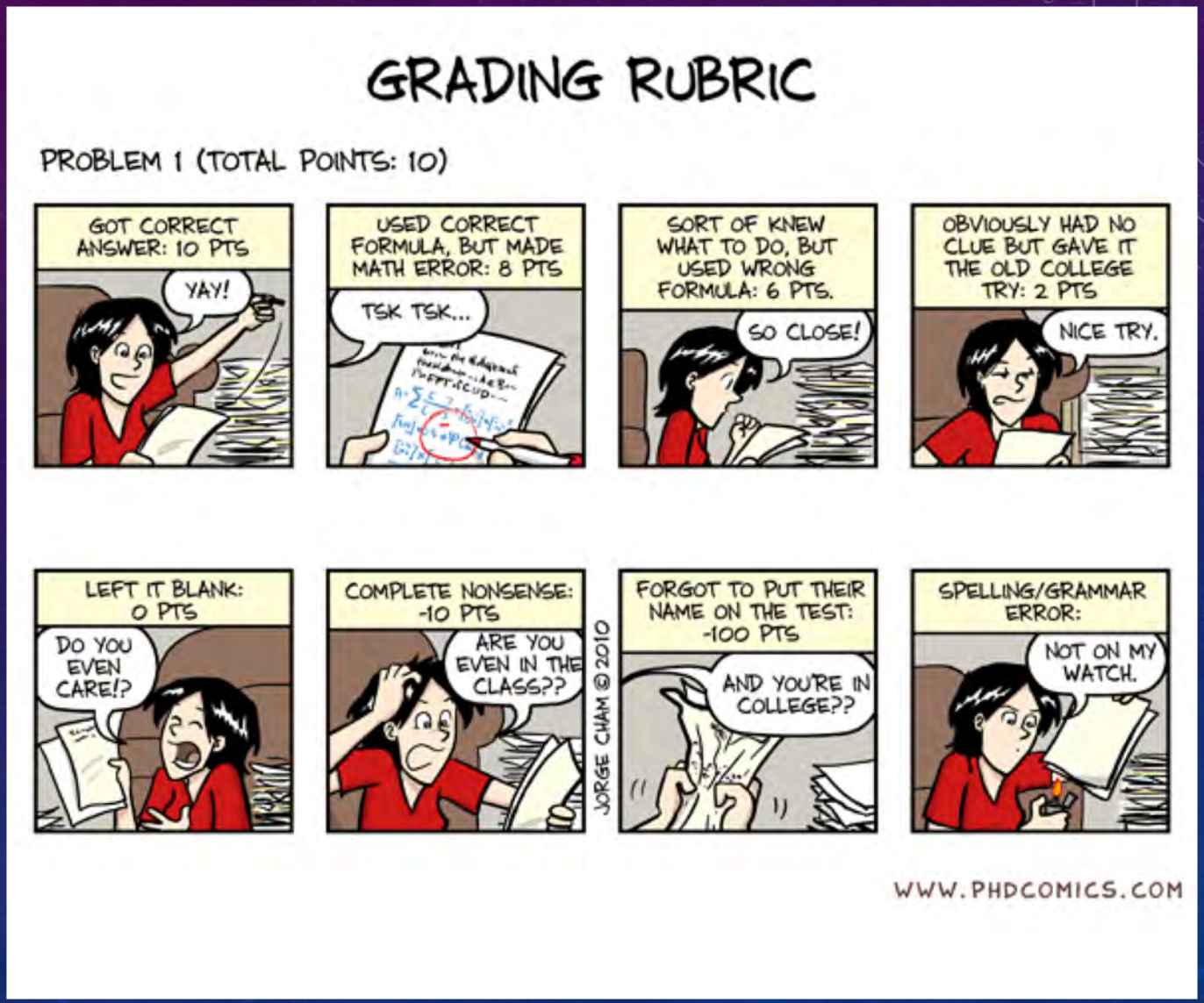
STANDARDS-BASED GRADING IN COLLEGE SCIENCE COURSES

LAURA MCCULLOUGH

UNIVERSITY OF WISCONSIN-STOUT

PROFESSOR OF PHYSICS

GRADING: THE WORST PART OF THE JOB!



TYPICAL POINTS MODEL OF GRADING

- What are the benefits?
- What are the problems?

SCENARIO A

- Adam has been averaging 70/100 on his tests, a bit lower than the average. With attendance and participation points, his final grade is a B+.
- Do you think Adam is a B+ student?

SCENARIO B

- Beth is getting near perfect scores on every test, but she never shows up to class. She told you that she had a really good high school class and learned it all then. With participation and attendance points, her final grade is a B+.
- Do you think Beth is a B+ student?

SCENARIO C

- Curtis is an engineering student who did great work on labs and projects, though his tests scores were around the B- mark. When he takes the next course in his major, the teacher is frustrated because Curtis can’t do a basic skill he should have learned in your class. But he got a B+ in your class.
- How do grades tell you what a student has learned?

SUMMATIVE ONLY GRADING

- Typical course assessments are focused on the summative—tests, final exam
- Learning is a process
- Growth mindset
- How does summative assessment help with growth?

- Why do we put feedback on exams?

GRADING PHILOSOPHIES

- Norm-referenced grading: standard curve, your grade tells you where you are relative to the class

- Criterion-referenced grading: your grade is based on a predetermined set of criteria

(Your philosophy might be between these two)

AN ALTERNATIVE TO POINTS: STANDARDS-BASED GRADING

- Been used for years at various educational levels
- Outcomes based
- Focuses on formative assessment

MY JOURNEY TO SBG

- Colleague in department tried it
- Community of practice in department
- Spring 2012 and onwards
- Started easy—used colleague's list of standards/course objectives
- Adjusted every semester
- Still adjusting!

WHAT IT LOOKS LIKE FOR ME

- No points, no attendance checked, no participation grades
- No homework collected
- Grades based solely on quizzes (assessments)
- Assessments directly tied to course objectives/standards
- Students have three tries per assessment
- Assessments weekly
- No final exam

SCHEDULE

- Thursday: start content (projectile motion concepts)
- Friday: projectile motion concepts and start problem solving [homework/practice available on D2L]
- Monday: lab on projectile motion
- Tuesday: practice problem solving [more practice on D2L]
- Wednesday: practice (1 hour) and assess (1 hour) on projectile motion
- Thursday: hand back assessment
- Friday through Thursday: Students re-assess up to two more times if necessary

REASSESSING

- Pros:
  - Students have motivation to go back and learn material
  - Three tries allows almost every student to pass
- Cons:
  - Lots of grading
  - Need many versions of assessments
- What other pros & cons can you think of?

GRADING

- Simplified scheme, no points
  - High Pass
  - Pass
  - Minor Error
  - Major Error
  - Insufficient/Incomplete
- Very fast; minimal feedback

STUDENT RESPONSIBILITY

- Students are responsible for their own learning, keeping track of what they need, what grade they are earning
  - They step up!
- Do homework as needed, do practice as needed
- Some students are comfortable skipping classes and showing up to assessments only

THE GOOD PARTS

- Student feedback is positive about the grading system
- I feel like students are more motivated
- Definitely puts the responsibility of learning on the student
- No keeping track of attendance or participation
- No graded homework
- No arguing about an 87 vs 88 on a test
- Start hard and they have a chance to improve without hurting their grade

THE BAD PARTS

- Students really like points; they understand how they are doing and they understand how to make the system work to their advantage
- Can be a lot of grading
- Takes time to implement
- Requires proctors or your time
- Might be uncomfortable at first

THE DETAILS—OBJECTIVES

- Used old tests to determine what I really was assessing/testing for
- Decided which objectives were absolutely essential to pass the class (to get a C)
- Other objectives help improve grade above C
  - Ended up with C-level and A-level objectives

THE DETAILS—OBJECTIVES

Projectile Motion

(C) I can solve problems involving objects experiencing projectile motion with horizontal launch.

(A) I can solve problems involving objects experiencing projectile motion with angled launch.

Balanced Forces

(C) I can draw a properly labeled force diagram showing all forces acting on an object.

(C) I can relate balanced/unbalanced forces to an object's constant/changing motion.

THE DETAILS—OBJECTIVES

Lab Standards

(C) I can communicate clearly in complete sentences.

(C) I include all necessary information in a lab report.

(C) I understand the errors associated with experimental designs.

Science Communication

(C) I can communicate clearly about science topics.

(C) I can critique a scientific research summary.

THE DETAILS--REASSESSING

- Google form for students to sign up
- I print at end of day for next day
- Different version for each day
- Open lab for retakes
- Student workers as proctors
- Available 10-20 hours a week
- Students show up, give name, get assessment
- Picked up at end of day for grading

THE DETAILS--GRADESCHEME

- Different for each course
- Based on objectives
  - C-level objectives
  - A-level objectives
- Pass on C-level earns *experience points* towards "C"
- High pass or A-level earns *skill points* towards "A"
- Number of points needed carefully calculated
  - All pass, no high pass → "B"
  - All high pass on C-level, no A-level → "B"

DETAILS: GRADESCHEME

PHYS-241 Experience Points/Skill Points Chart

A-level objectives (earn SP)

4 ___ = ___ SP	6 ___ = ___ SP	11 ___ = ___ SP	14 ___ = ___ SP	15 ___ = ___ SP	17 ___ = ___ SP	20 ___ = ___ SP	24 ___ = ___ SP

A-level:
Pass = 10 SP
High Pass = 20 SP

C-level objectives (earn XP and SP)

Constant Velocity	Constant Acceleration		Projectiles	Balanced Forces		Unbalanced Forces	
1 ___ = ___ XP	2___ = ___ XP	3___ = ___ XP + ___ SP	5___ = ___ XP + ___ SP	7___ = ___ XP	8___ = ___ XP	9___ = ___ XP + ___ SP	10___ = ___ XP + ___ SP

Circular Motion		Springs	Balanced Torques		Conservation of Energy			Momentum
12___ = ___ XP	13___ = ___ XP	16___ = ___ XP	18___ = ___ XP	19___ = ___ XP + ___ SP	21___ = ___ XP	22___ = ___ XP	23___ = ___ XP + ___ SP	25___ = ___ XP + ___ SP

Lab Standards (average of top 3)			Science Communication (avg of top 5)	
26___ = ___ XP	27___ = ___ XP	28___ = ___ XP	29___ = ___ XP	30___ = ___ XP

C-level:
Pass = 1 XP
High Pass = 1 XP + 10 SP

	F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A
XP needed	<12	12	14	16	18	20	20	20	20	20	20	20
SP needed							30	50	70	110	150	200
Your level												

LEVEL UP YOUR PHYSICS!

College Physics I Fall 2018 Professor Laura McCullough

DETAILS: GRADEBOOK

5	I can solve problems involving objects experiencing projectile motion with horizontal launch.
6	I can solve problems involving objects experiencing projectile motion with angled launch.

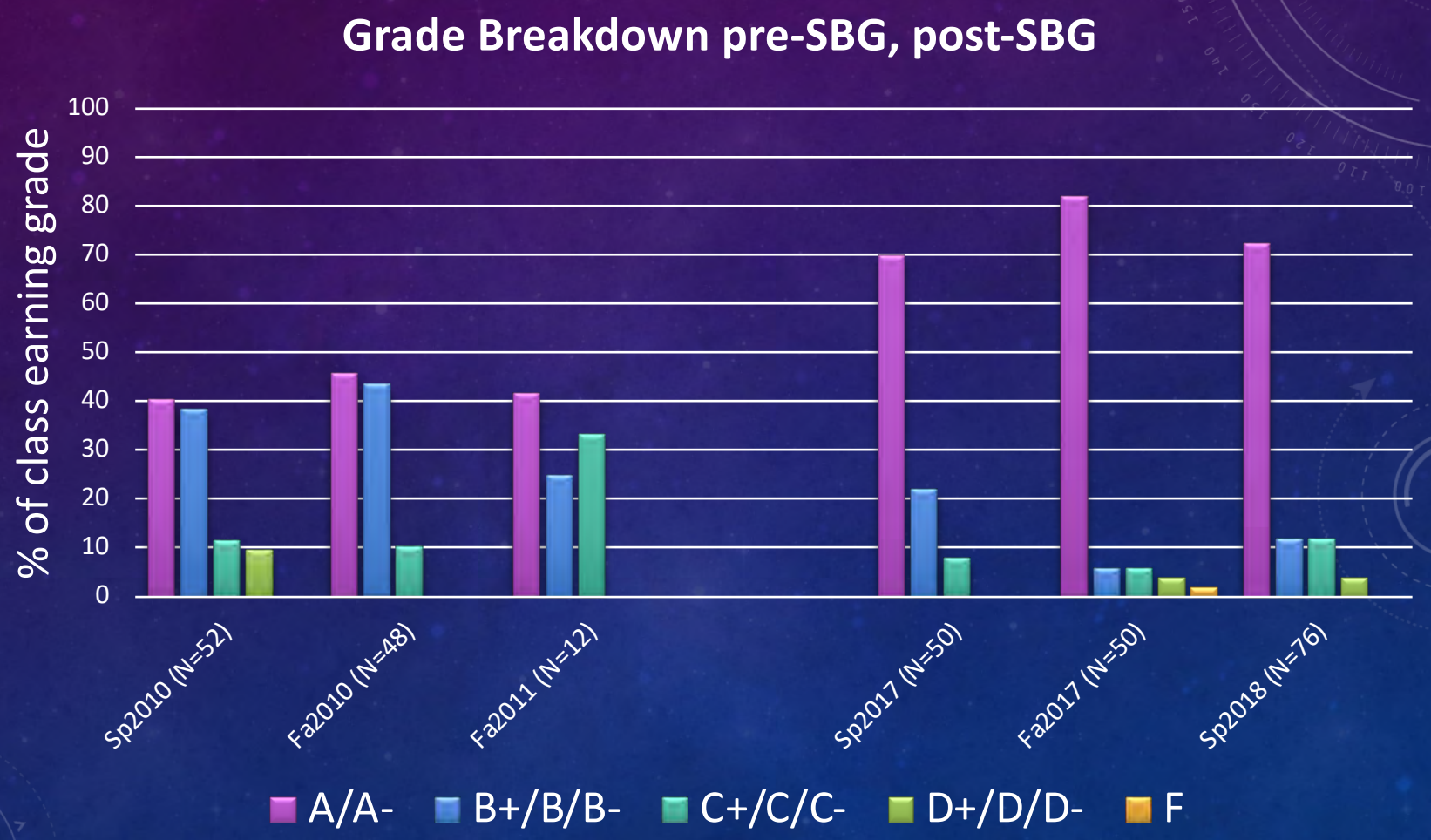
	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6
Student 1	3							3	3	2	3	3			
Student 2															
Student 3	4	4													
Student 4	2	3	5	5				2	1	3	5	5			
Student 5	1	1						1	1						
Student 6	5	5						5	5						
Student 7	4	4	5	5				5	5						
Student 8	1	1						2	2						
Student 9	3	5						5	5						
Student 10	5	5						3	3	5	3				
Student 11	4	2						5	1						
Student 12	5							4	3						
Student 13	4	4						2	4						
Student 14	5	3						5							
Student 15	5	2						3	1	5	3				
Student 16	5	5						3	3						

DETAILS: GRADEBOOK

									a		a		a			a			a	a		a			a				a				
	c	c	c	c	c	c	c	c			c		c		c	c		c	c			c		c	c		c	c	c		c		Final grade
	LAB26	LAB27	LAB28	SC29	SC30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	XP	SP
Student 1	4.0	2.3	4.0	2.4	2	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 2	1.3	1.3	1.3	0.8	0.6	3	3	2	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 3	4.0	3.7	4.0	1.6	1.4	4	3	4	4	4	0	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 4	3.7	2.7	3.7	2.4	1.8	4	3	5	5	5	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 5	1.0	1.3	1.3	1.6	1.2	3	3	0	0	1	1	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 6	3.7	2.0	3.0	2.4	2.2	4	4	5	5	5	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 7	4.0	3.0	3.7	2.4	2	4	4	5	5	5	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 8	3.3	3.0	3.0	2.2	2.2	4	4	4	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 9	3.7	3.7	4.0	2.4	2.2	4	4	5	5	5	5	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 10	4.0	2.7	2.7	2.4	1.8	4	4	5	5	5	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 11	4.0	3.3	4.0	0.8	0.6	4	3	3	3	4	5	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 12	4.0	2.7	2.7	2	1.6	4	4	5	5	5	4	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 13	3.7	2.7	3.3	2	1.8	4	3	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 14	2.7	2.3	3.0	1.4	1.4	4	3	5	4	5	5	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 15	3.7	4.0	3.7	2.4	2.4	4	4	5	3	5	5	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Student 16	3.3	2.7	4.0	0.6	0.4	4	4	5	4	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Average score	3.6	3.0	3.4	1.9	1.8	3.8	3.7	4.4	4.0	4.4	4.3	2.6	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
# passing	17	6	17	0	0	44	35	40	35	42	40	12	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
% passing	35.4	12.5	35.4	0.0	0.0	90	71	82	71	85.7	81.6	24.5	42.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

SN grading | Roster | Names | Labs | SC | CV CA | Proj | BF | UBF | Circular | Spring | BT | CE | Mom | Summary

THE DETAILS: EFFECT ON GRADES



IS SBG RIGHT FOR YOU?

- Criteria-based or norm-based grading?
- Clear set of objectives?
- Resource availability?
- Other issues?

HOW COULD YOU START?

- Step one: develop set of objectives based on current class
  - Decide if all objectives are equal or if you want levels
  - Determine what needs to be known for passing/”C” grade
- Step two: determine resources (current/needed)
  - Grading help?
  - Proctor room and proctors?
- Step three: given your resources and your philosophy, how many retakes? Timeframe for retakes?

MOVING TOWARDS SBG

- Step four: develop grading scheme
  - Ease of understanding how grade is earned
  - Ease of calculating grade
  - Ease of keeping track of grades
  - Level of feedback given
- Step five: write an assessment designed for one or more objectives
- Step six: get colleagues to look at your plan***
- Step seven: make (frantic, last-minute) changes

MOVING TOWARDS SBG

- Step eight: set low expectations for the first run
- Step nine: give it a try!
- Step ten: tweak, adjust, retry
- Step eleven: repeat step ten

RESOURCES

- Laura McCullough: McCulloughL@uwstout.edu
- https://www.chemedx.org/article/standards-based-grading-chemistry-classroom
- http://mctownsley.net/top-10-standards-based-grading-articles/

Thank you!