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How Structuring our Physics Courses with Grades Based on Standards has Transformed our Pedagogy

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STANDARDS BASED GRADING IN HIGH SCHOOL PHYSICS CLASSES

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How Structuring our Physics Courses with Grades Based on Standards has Transformed our Pedagogy

March 31. 2023

TODAY'S PLAN:

- Introductions
- Why transition to
  Standards Based Grading?
- Our Story - in 2 parts
- Resulting Mindset Shift

Our Team

Sara

Camille

Sasha

As a Group...

Use the QR Code to share a little about yourself

WHY TRANSITION?

Research that supports the change

EQUITABLE GRADING PRACTICES

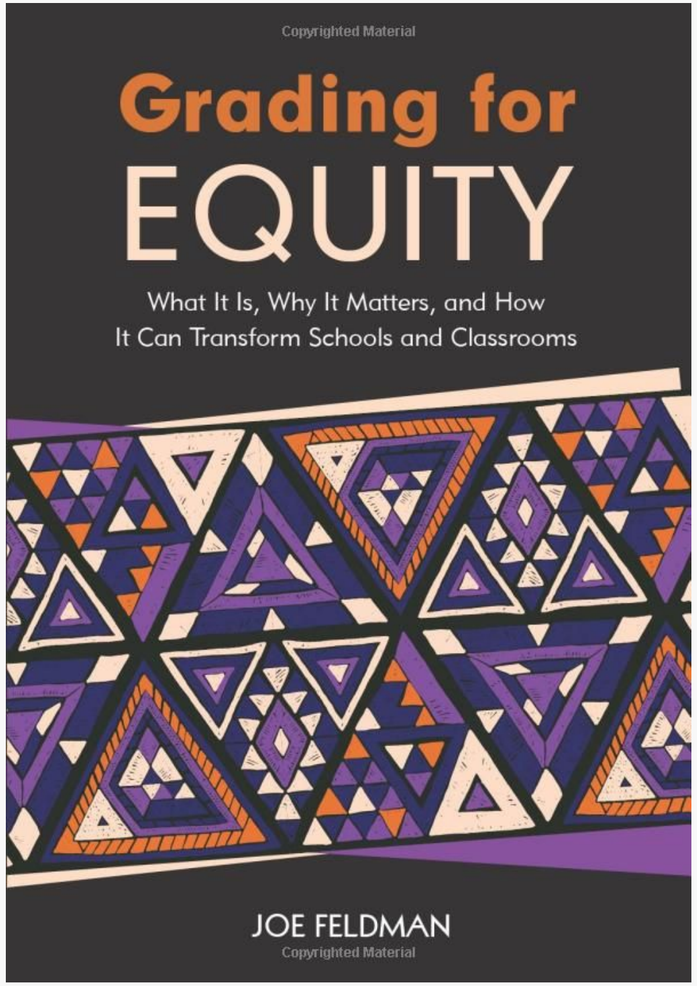
Joe Feldman

CULTURALLY RESPONSIVE TEACHING AND THE BRAIN

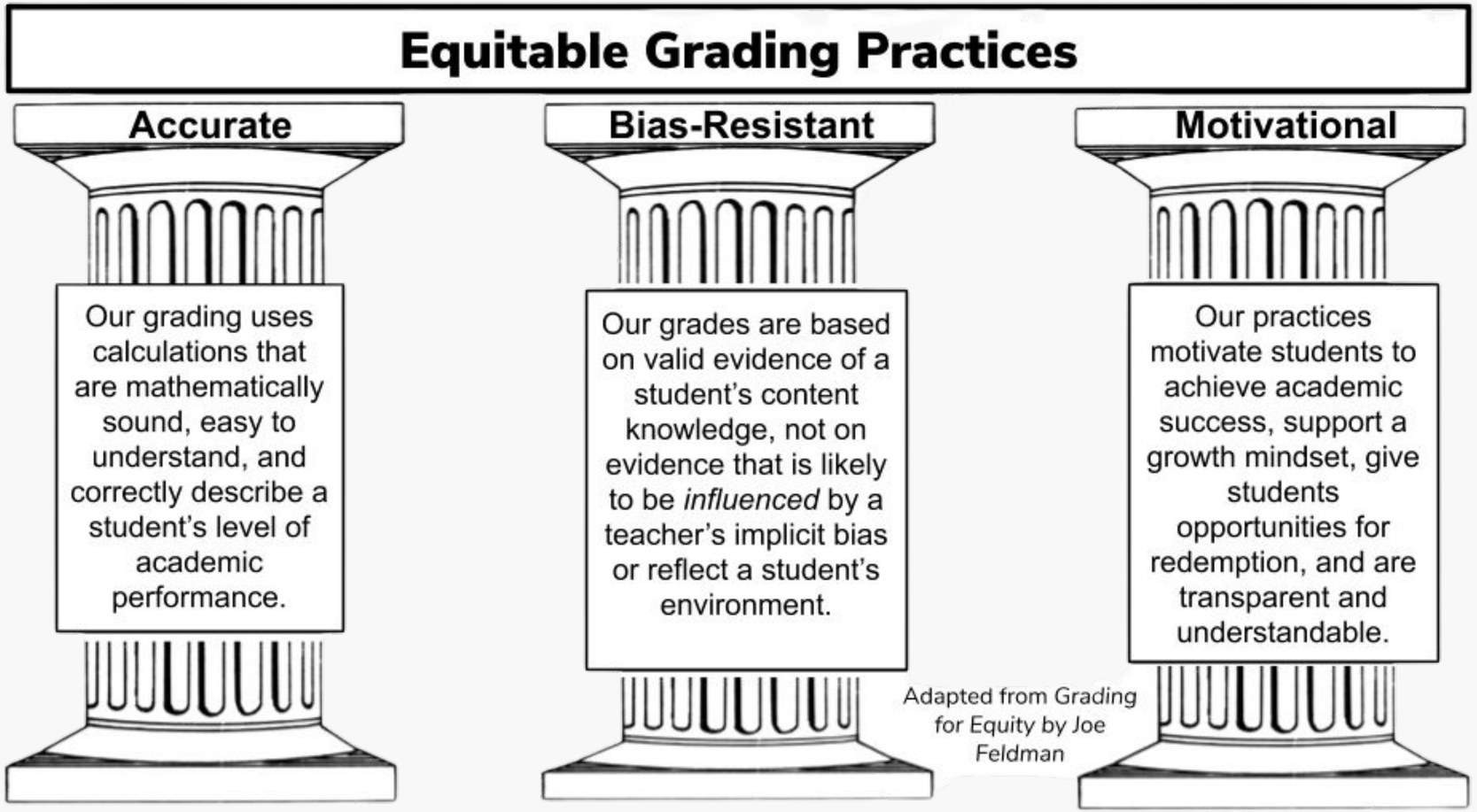
Zaretta Hammond

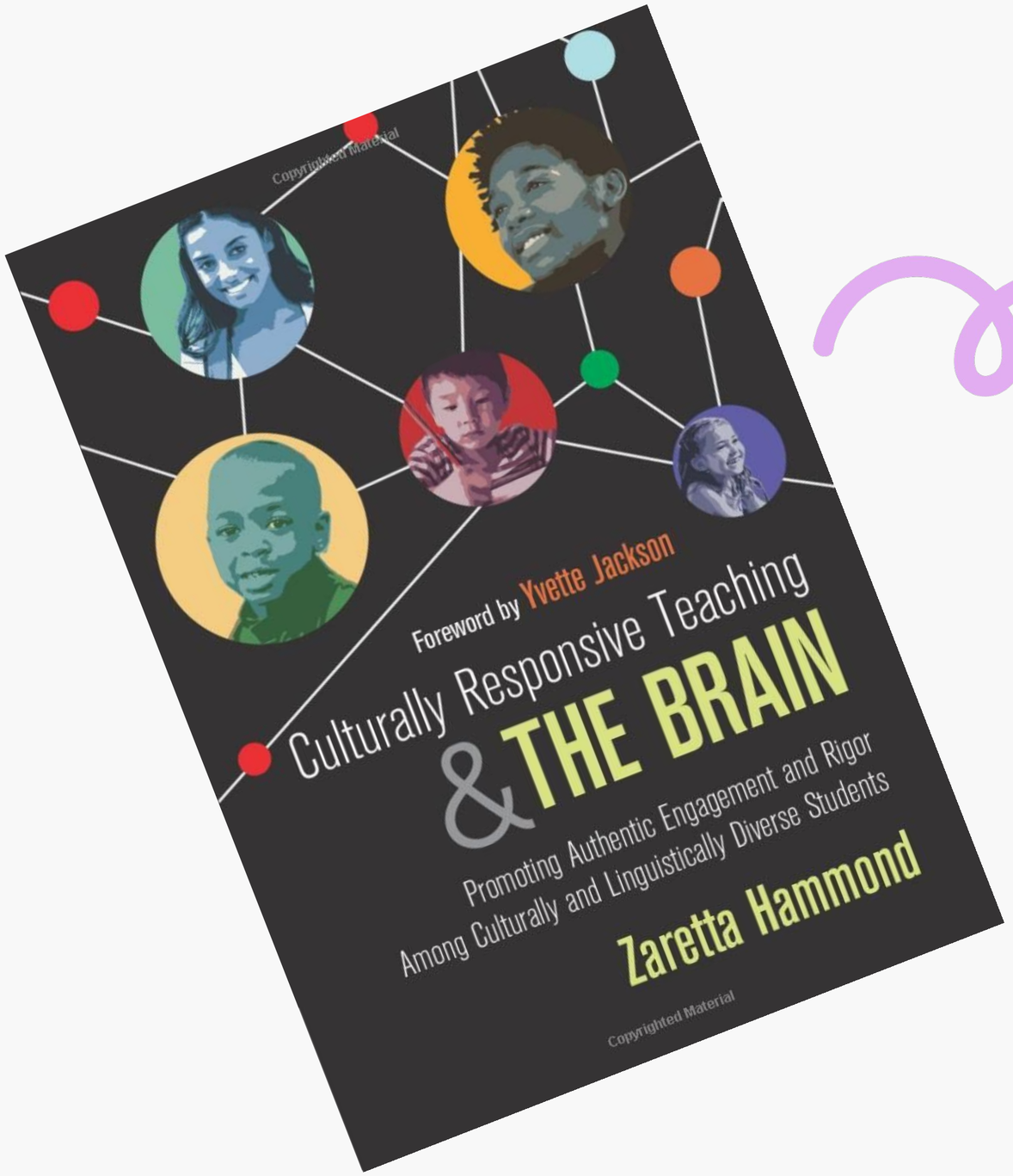
GROWTH MINDSET

Carol Dweck



"Grades must accurately reflect only a student's academic level of performance, exclude nonacademic criteria (such as behavior), and use mathematically sound calculations and scales, such as the 0–4 instead of the 0–100 scale."
-Joe Feldman

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Foreword by Yvette Jackson
Culturally Responsive Teaching
& THE BRAIN
Promoting Authentic Engagement and Rigor
Among Culturally and Linguistically Diverse Students
Zaretta Hammond
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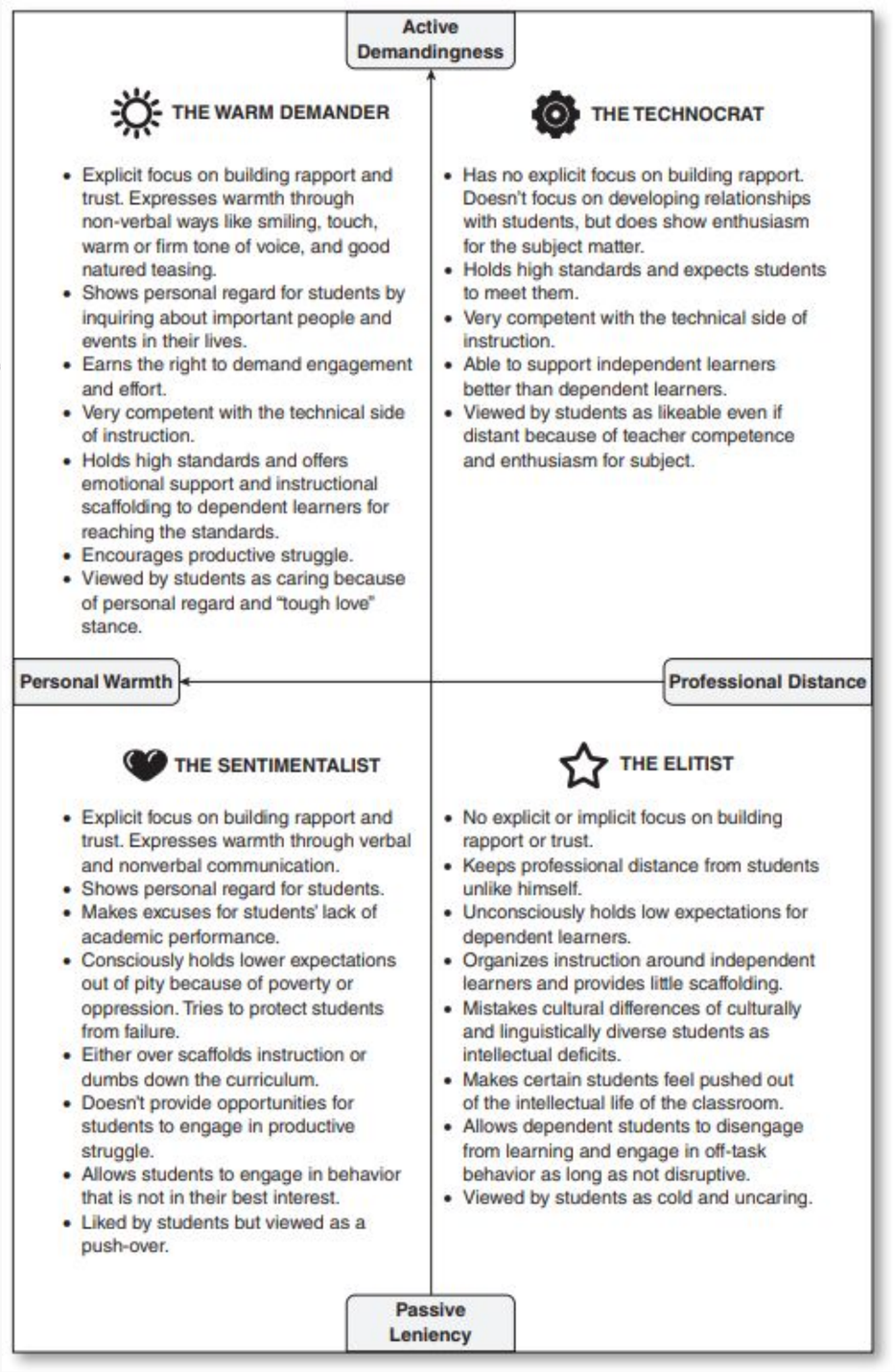
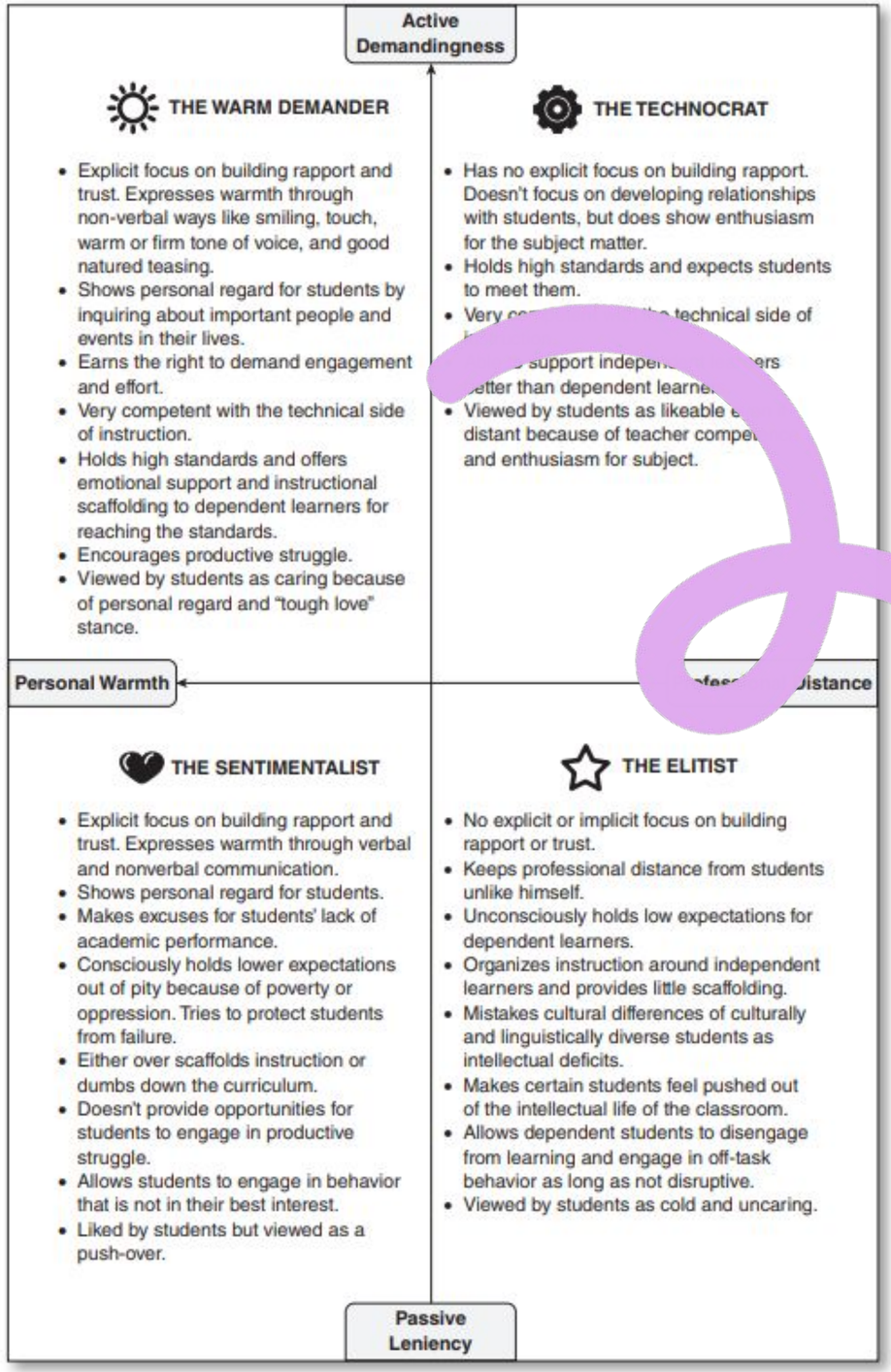
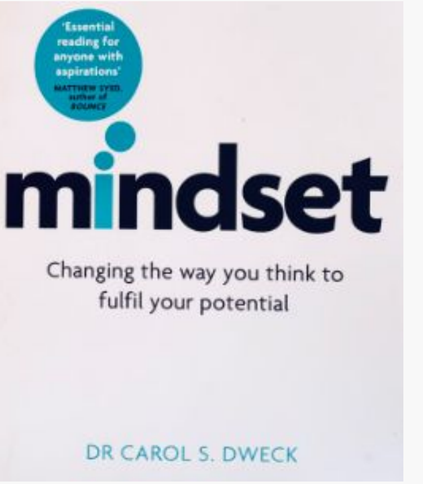

Active Demandingness
THE WARM DEMANDER
Explicit focus on building rapport and trust. Expresses warmth through non-verbal ways like smiling, touch, warm or firm tone of voice, and good natured teasing.
Shows personal regard for students by inquiring about important people and events in their lives.
Earns the right to demand engagement and effort.
Very competent with the technical side of instruction.
Holds high standards and offers emotional support and instructional scaffolding to dependent learners for reaching the standards.
Encourages productive struggle.
Viewed by students as caring because of personal regard and "tough love" stance.
THE TECHNOCRAT
Has no explicit focus on building rapport. Doesn't focus on developing relationships with students, but does show enthusiasm for the subject matter.
Holds high standards and expects students to meet them.
Very competent with the technical side of instruction.
Able to support independent learners better than dependent learners.
Viewed by students as likeable even if distant because of teacher competence and enthusiasm for subject.
Personal Warmth
Professional Distance
THE SENTIMENTALIST
Explicit focus on building rapport and trust. Expresses warmth through verbal and nonverbal communication.
Shows personal regard for students.
Makes excuses for students' lack of academic performance.
Consciously holds lower expectations out of pity because of poverty or oppression. Tries to protect students from failure.
Either over scaffolds instruction or dumbs down the curriculum.
Doesn't provide opportunities for students to engage in productive struggle.
Allows students to engage in behavior that is not in their best interest.
Liked by students but viewed as a push-over.
THE ELITIST
No explicit or implicit focus on building rapport or trust.
Keeps professional distance from students unlike himself.
Unconsciously holds low expectations for dependent learners.
Organizes instruction around independent learners and provides little scaffolding.
Mistakes cultural differences of culturally and linguistically diverse students as intellectual deficits.
Makes certain students feel pushed out of the intellectual life of the classroom.
Allows dependent students to disengage from learning and engage in off-task behavior as long as not disruptive.
Viewed by students as cold and uncaring.
Passive Leniency



THE WARM DEMANDER

- Explicit focus on building rapport and trust. Expresses warmth through non-verbal ways like smiling, touch, warm or firm tone of voice, and good natured teasing.
- Shows personal regard for students by inquiring about important people and events in their lives.
- Earns the right to demand engagement and effort.
- Very competent with the technical side of instruction.
- Holds high standards and offers emotional support and instructional scaffolding to dependent learners for reaching the standards.
- Encourages productive struggle.
- Viewed by students as caring because of personal regard and "tough love" stance.


"Failure is the limit of my abilities"
FIXED MINDSET
"I'm either good at it or I'm not"
"My abilities are unchanging"
"I don't like to be challenged"
"I can either do it, or I can't"
"My potential is predetermined"
"When I'm frustrated, I give up"
"Feedback and criticism are personal
"I stick to what I know"
"Failure is an opportunity to grow"
GROWTH MINDSET
"I can learn to do anything I want"
"Challenges help me to grow"
"My effort and attitude determine my abilities"
"Feedback is constructive"
"I am inspired by the success of others"
"I like to try new things"


'Essential reading for anyone with aspirations'
mindset
Changing the way you think to fulfil your potential
DR CAROL S. DWECK

Our Story -

Defining Standards

&

Determining Scales

General Physics: Before

Defining Standards

Content Units	Items to be Graded	Grading Scale
Unit 1: Kinematics Unit 2: Forces & Newton's Laws Unit 3: Pmomentum Unit 4: Energy Unit 5: Waves Unit 6: Light Unit 7: Electricity	Daily Homework Quizzes Tests Corrections (1/2 credit)	A: 90% - 100% B: 80% - 89% C: 70% - 79% D: 60% - 69% F: 59% and below

General Physics: Now

Defining Standards

Content Standards	Items to be Graded	Grading Scale
Kinematics - 6 standards Forces & Newton's Laws - 3 standards Pmomentum - 3 standards Energy - 3 standards Waves - 4 standards Light - 5 standards Electricity - 2 standards	Quizzes Tests	Advanced (5) Proficient (4) Developing (3) Emerging (2) Beginning (1)

Content Standards - Trimester 1

Unit 1: Constant Velocity

- 1.1: I can draw and interpret diagrams to represent the motion of an object moving with a constant velocity.
- 1.2: I can solve quantitative problems involving constant velocity using the GUESS method.

Unit 2: Constant Acceleration

- 2.1: I can draw and interpret diagrams to represent the motion of an object moving with a constant acceleration.
- 2.2: I can solve quantitative problems involving constant acceleration.

Unit 3: Projectile Motion

- 3.1: I can solve problems involving a projectile with no initial vertical velocity.
- 3.2: I can solve problems involving a projectile with initial vertical velocity.

Unit 4: Forces

- 4.1: I can draw free-body diagrams.
- 4.2: I can write net force equations to represent the forces acting on an object and its motion.
- 4.3: I can solve quantitative problems involving net force equations for linear motion.
- 4.4: I can solve quantitative problems involving net force equations for uniform circular motion.

Sample Assessment: before

"Please discuss…but all of the work should be your own"

"Points awarded for…"

Please discuss/work with classmates but all of the work on your paper should be your own! Round all calculated values to the nearest hundredth. Each problem will be worth 4-5 points. Points are awarded for:

- Complete FBD
- 2 complete F_{net} equations
- Correct physics work
- Correct answers with units

1. Beaker is trying to move a large 6.4 kg box across a horizontal floor. When he applies a force of 22 N downward at an angle that measures 17 degrees from the horizontal, the box does not move. Use F_{NET} equations to determine:
    a. the normal force acting on the box
    b. the force of friction acting on the box

"Each problem is worth 4-5 points"

Success determined by correct numerical answer

Sample Assessment: Now

All graded assessments are individual - following LOTS of practice!

Scores given for each standard

Proficiency scale used for each standard

4.1	I can draw free-body diagrams.	~~Advanced (5)~~ Proficient (4) Developing (3) Emerging (2) Beginning (1)
4.2	I can write net force equations to represent the forces acting on an object and its motion.	~~Advanced (5)~~ Proficient (4) Developing (3) Emerging (2) Beginning (1)
4.3	I can solve quantitative problems involving net force equations for linear motion.	~~Advanced (5)~~ Proficient (4) Developing (3) Emerging (2) Beginning (1)

Beaker is trying to move a large 6.4 kg box across a horizontal floor. When he applies a force of 22 N downward at an angle that measures 17 degrees from the horizontal, the box does not move. Determine the value of both the normal force and the frictional force.

FBD:

$F_{net\ x/\parallel}$:

$F_{net\ y/\perp}$:

Givens:

Unknown(s):

(put a box around your answers & include units)

Success or struggle on one part of problem does not impact opportunity to succeed on other parts.

Our Story -

Defining Standards

&

Determining Scales

Building-Wide Collaboration Spring & Summer 2022

April

Outreach to Colleagues throughout Building

Received approval for Teacher Quality Summer Project

May

Collaborate to define SBG

Seeking out resources

June

Develop common language for scales

Discuss various options for grade calculation

July

Create documentation for use in consistent implementation & presentation throughout building

Discuss how to utilize current grade recording to reflect new grading

Developing Common Language

A+ (5)	Beyond course expectations	Exemplary, Advanced, Excessed, Highly, Mastery, Beyond
A (4)	This is the goal	Mastery, Proficient, Meeting, Achieving, Competent
B (3)		Developing, In Progress, Approaching, Progressing, In Process
C (2)		Emerging
D (1)		Limited Progress, Needs Assistance, Below, Basic, Insufficient, Beginning
F (0)		No evidence, Not submitted

Discussion of Options for Grade Calculation

Menu of options for a department to choose:

- Average of 2 highest -
  - with 3-4 opportunities
- Most recent submission / highest score
- Average of all submissions
- Teacher judgement -
  - with artifacts to support

Liberty Standards Based Grading

Descriptions and Examples for Students and Parents

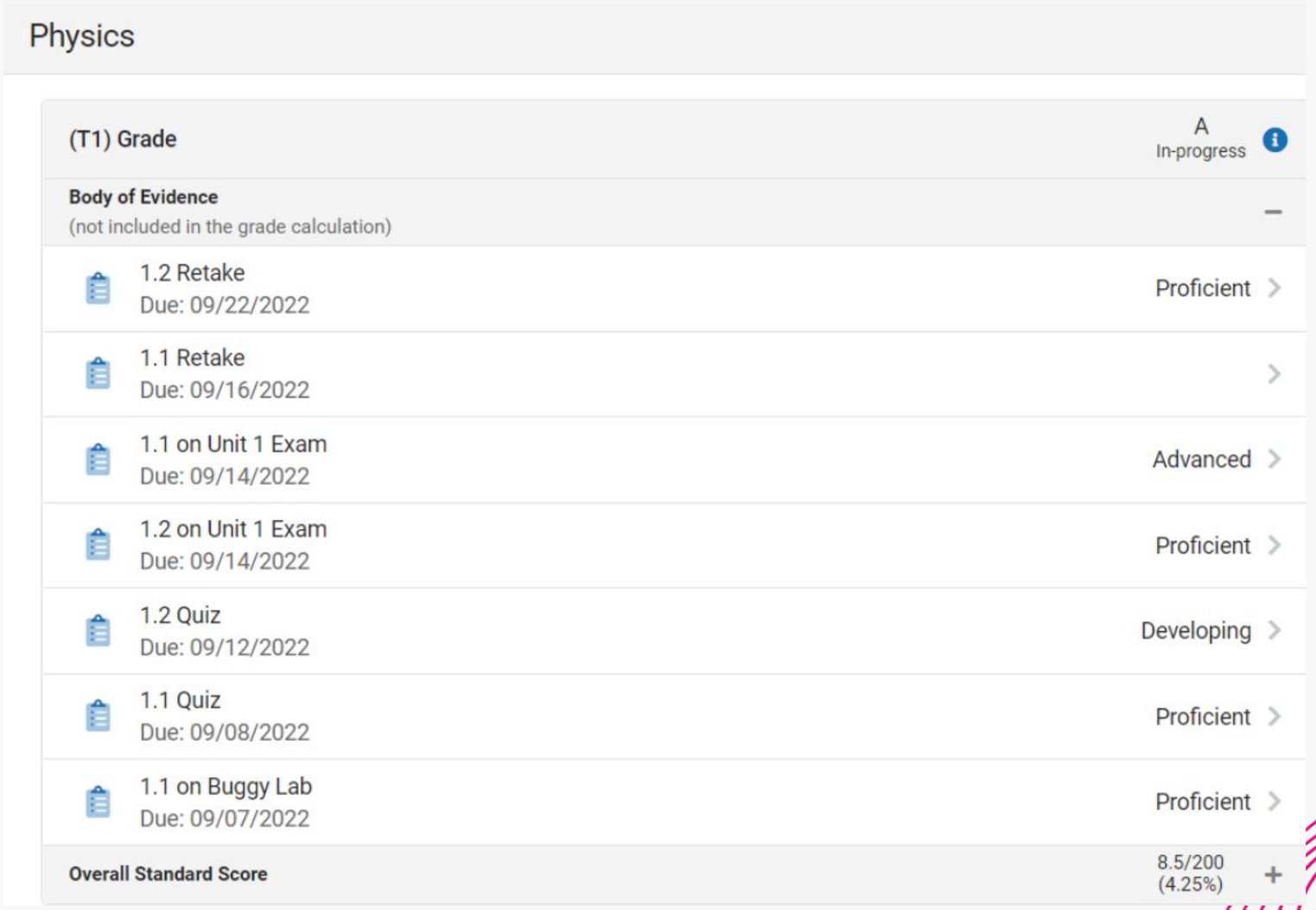
Proficiency Level and "Grade"	0 - No Evidence "F"	1 - Beginning "D"	2 - Emerging "C"	3 - Developing "B"	4 - Proficient "A"	5 - Advanced "A+"
Student Description	• I have not yet submitted evidence to demonstrate progress on the standard.	• The evidence I have submitted so far shows I need assistance to demonstrate the standard.	• I have the foundation of the skills and knowledge for the standard, but there are key concepts I am still working on.	• I have a firm foundation of the skills and knowledge needed to demonstrate the standard, and I am close to Proficient (4).	• **I have independently met the standard, but my work may include errors that don't impact demonstration of the standard.** • ***This is the goal for course-level mastery and should be celebrated!***	• **I have demonstrated deep understanding and/or application that exceeds the standard.**
Student Examples	• I have not completed the assessment/assignment • I wrote down something completely unrelated to the content. For example, your answer to a math problem was "Pokemon" • *A submitted assessment with no evidence does not automatically earn you a retake*	• I can rarely start a problem without relying heavily on outside support • Right now, I can solve problems only with my teacher guiding me through the process • *I need to come in during Liberty Time to work one-on-one with my teacher*	• I can do parts of a problem/process independently without relying on outside support. • *I need to come in during Liberty Time to work with my teacher*	• I can identify my point of confusion but need outside assistance to solve it. • I sometimes need prompting to recognize my own errors.	• **I can almost always independently solve the problems or demonstrate the skills my teacher presents.** • **I can identify my point of confusion and independently solve it.**	• **I can confidently teach someone else without outside resources.** • **I can work independently beyond course-level concepts and skills.**

A closer look at one level of the 5-point scale

Scale Descriptor	Examples for Students	Guidance for Teachers
2 - Emerging "C" • I have the foundation of the skills and knowledge for the standard, but there are key concepts I am still working on.	• I can do parts of a problem/process independently without relying on outside support. • *I need to come in during Liberty Time to work with my teacher*	• Still close to Beginning (1) • Teacher prompting is *often* necessary for skill to be demonstrated • Can do a problem by rote but doesn't seem to fully grasp the concept; cannot transfer to a new situation • Inconsistent generalization across days and novel tasks.

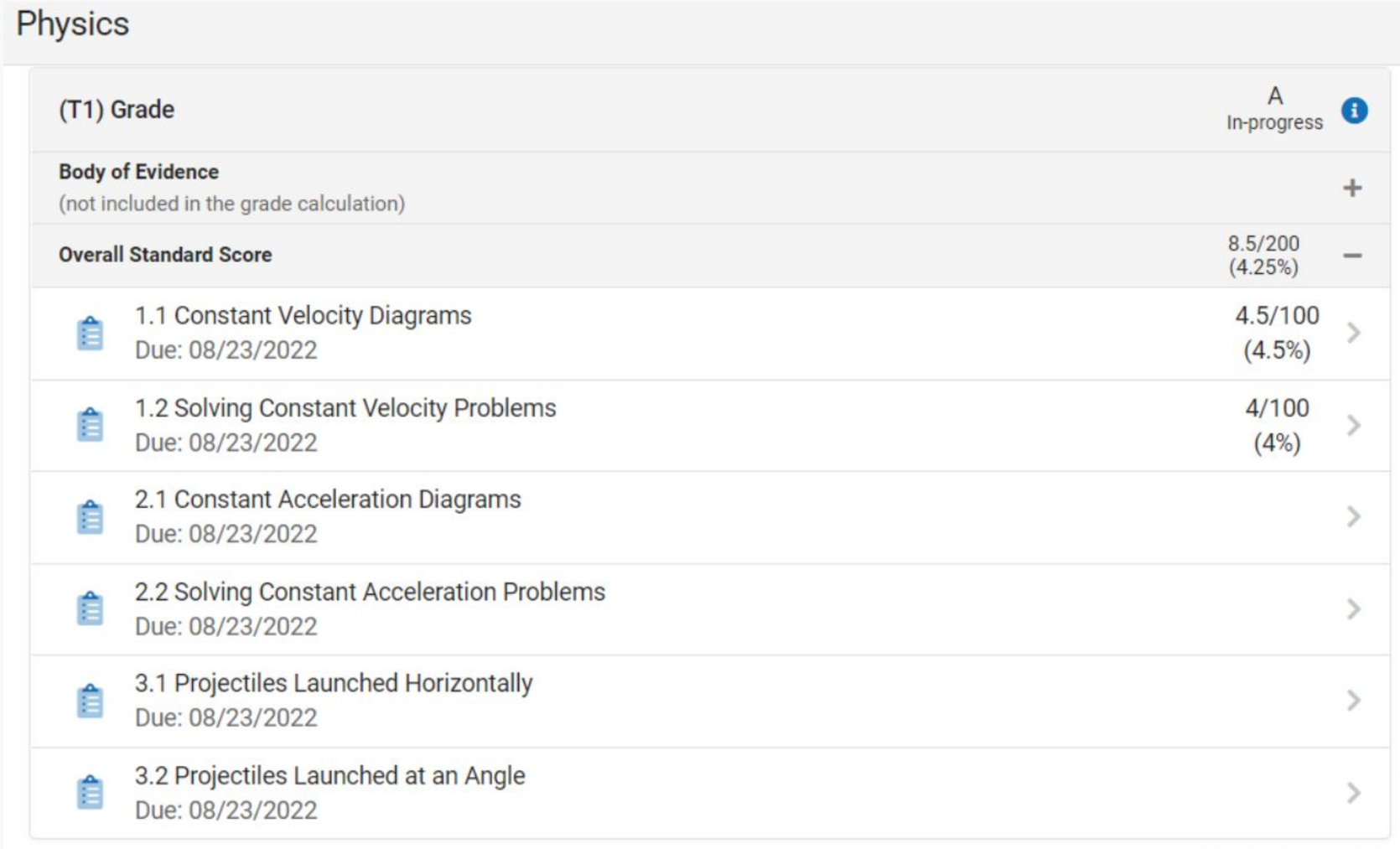
Translating Scores into 'Grades' in Physics

Assessments make up the Body of Evidence



Translating Scores into 'Grades' in Physics

Use Body of Evidence to Determine Standard Score



GRADE	MIN PERCENT
A+	4.5
A	3.5
B	2.5
C	1.5
D	0.5
F	0.0

MINDSET SHIFTS

Some quite unexpected

GRADING PRACTICES & ASSESSMENT STRATEGY

TEACHING PHILOSOPHY & PEDAGODGY

STUDENT REACTION

7.2 I can solve quantitative problems involving the wave equation for all waves.

~~Advanced (5)~~
Proficient (4)
Developing (3)
Emerging (2)
Beginning (1)

Quiz #1 Required

Show your work using the GUESS method!

Middle C is a sound wave with a frequency of 0.256 kHz and moves 345 m/s through room-temperature air.

1. What is the wavelength of Middle C?

2. What is the period of Middle C?

Quiz #2 Optional: following reteaching

7.2 I can solve quantitative problems involving the wave equation for all waves.

~~Advanced (5)~~
Proficient (4)
Developing (3)
Emerging (2)
Beginning (1)

Show your work using the GUESS method!

A wave traveling 4.2×10^{5} m/s has a period of 5×10^{-4} s.

1. What is its frequency?

2. What is its wavelength?

~~Advanced (5)~~
Proficient (4)

7.2 I can solve quantitative problems involving the wave equation for all waves.

~~Advanced (5)~~
Proficient (4)
Developing (3)
Emerging (2)
Beginning (1)

Quiz #1
Required

Quiz #2
Optional: following reteaching

Show your work using the GUESS method!

1. A wave traveling 4.2×10^{5} m/s has a period of 5×10^{-4} s.
   1. What is its frequency?

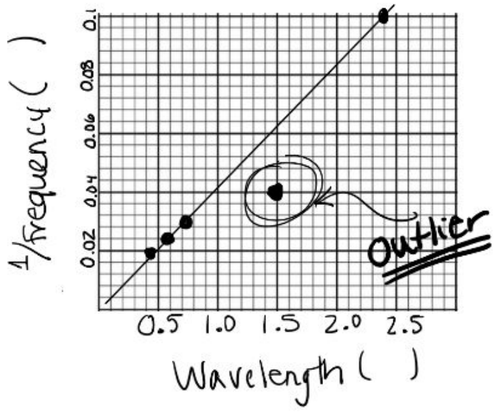
7.2 I can solve quantitative problems involving the wave equation for all waves.

~~Advanced (5)~~
Proficient (4)
Developing (3)
Emerging (2)
Beginning (1)

Show your work & include units on your answers for questions 2 & 3.

A group of physics students collected and graphed the following data utilizing a standing wave lab apparatus similar to the one you used in class this week.

1. Based on the graph axes, identify the units associated with data on both the x and y axes.
2. **Using the identified *outlier point,*** determine the experimental speed based on this data point.
3. **Using the best-fit line,** determine the graphical average speed of the wave in their string.
   *Hint - the answers to questions 2 and 3 will **NOT** be the same!*



1. Units on each axis:

   X axis: _____ Y axis: _____

2. Experimental speed based on *outlier* data point:

3. Graphical average speed based on *best fit line:*

Lab Quiz
Required

7.2 I can solve quantitative problems involving the wave equation for all waves.

Advanced (5)
Proficient (4)
Developing (3)
Emerging (2)
Beginning (1)

Show your work using the GUESS method!
A transverse periodic wave with an amplitude of 2 m, a wavelength of 0.23 m, and
through a rope resting on the floor.

4. What is the frequency of the periodic wave?

5. Explain *how* you would determine the wave's period AND determine th

Unit Test
Required
with optional
Advanced question

Advanced Question (optional): *Complete this question, in addition to the other questions for this standard, to demonstrate that your performance level is beyond course-level concepts and skills*
Spectators at a sporting event do "The Wave" - as shown at right.

a. *Is this a transverse or longitudinal wave? How do you know?*

b. *If the crowd is into it, and it goes around the stadium multiple times, describe how you might measure the frequency, amplitude, and speed of the wave.*

End of Trimester "Phinal"
Optional with Optional Advanced question

Mindset Shift: Grading Practices & Assessment

Assessments are not a chance for more points, they are an opportunity to demonstrate growth in understanding

6.1Q Seq: 6.11 Due: 02/13 Body of Evide Points: 0	6.1Q2 Seq: 6.12 Due: 02/27 Body of Evide Points: 0	6.1P Seq: 6.13 Due: 03/01 Body of Evide Points: 0	6.1SS Seq: 6.19 Due: 03/02 Overall Standa Points: 100	6.2Q Seq: 6.21 Due: 02/21 Body of Evide Points: 0	6.2Q2 Seq: 6.22 Due: 02/27 Body of Evide Points: 0	6.2P Seq: 6.23 Due: 03/01 Body of Evide Points: 0	6.2SS Seq: 6.29 Due: 03/02 Overall Standa Points: 100
Proficient	Proficient	Proficient	4	Developing	Developing	Emerging	3
Emerging	Beginning	Beginning	1.5	Beginning	Beginning	Beginning	1
Beginning	NoEvidence	NoEvidence	.5	Emerging	Proficient	Developing	3.5
Proficient	Proficient	Proficient	4	Proficient	Developing	Proficient	4
Emerging	Proficient	Developing	3.5	Developing	Developing	Developing	3

Mindset Shift: Approach to Practice/Homework

Name: Period:

Unit 6: Energy

6.2: I can define a system and identify the types of energy and relative amounts in the system at various points.

6.2 Quiz is on

Required Activities:

- ☐ Notes: Law of Conservation of Energy (p. 2)
- ☐ Notes: Creating LOL Charts (p. 3)
- ☐ Required Practice: Conservation of Energy (p. 4)
- ☐ Notes: Defining the System (p. 5)
- ☐ Required Practice: Systems & Energy (p. 6-7)

Support and Practice: *Choose at least 2 of the following*

- ☐ Practice: LOL Charts I (p. 8 in packet)
- ☐ Practice: LOL Charts II (p. 9 in packet)
- ☐ Practice: Ranking Tasks (p. 10-11 in packet)
- ☐ Support: Textbook Reading *(pg 162; 169 - 174)*

Answer keys to practice problems can be found on p. 12

MATT TOWNSLEY EdD

EDUCATION AND ASSESSMENT/GRADING ENTHUSIAST

Repurposing homework and checks for understanding as ungraded practice

STOP:

"Each homework assignment is worth 5 points...and homework is 15% of your final grade. Quizzes are worth 25% of the final grade."

START:

"The purpose of homework and quizzes is practice; therefore, I will report them separately and provide you with non-numerical feedback so that you can learn from your mistakes"

Mindset Shift: Student Feedback

At first I didn't like it, but I did like it towards the end because it assesses my learning and not just a composite score of tests and quizzes. It brings down stress levels with grading as well because it's straight forward.

This system actually made me feel like school was about learning and tests were about showing what I knew instead of just doing busy work. I spent more time working on understanding the topics than I did memorizing formulas and other stuff.

At first I thought it was weird and unnecessary, and just confused things. But now that I understand it I realize that it is better, because I could miss half of the problems, learn what I did wrong and fix it and still have an A because by the end I still understood it.

Mindset Shift: Student Feedback

It made me less focused on my grade in the class and more focused on listening and learning the material.

It felt weird at the beginning of the year since it's different, but I've gotten used to it. I don't feel like you could have a good physics class without it anymore.

Thank you!

Questions?

STANDARDS BASED GRADING IN HIGH SCHOOL

SARA KARBELING

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AND SASHA MURPHY

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Iowa City Community Schools

March 31. 2023