THE FAST AND THE CURIOUS

SALT LAKE CITY SCHOOL DISTRICT
Your Best Choice

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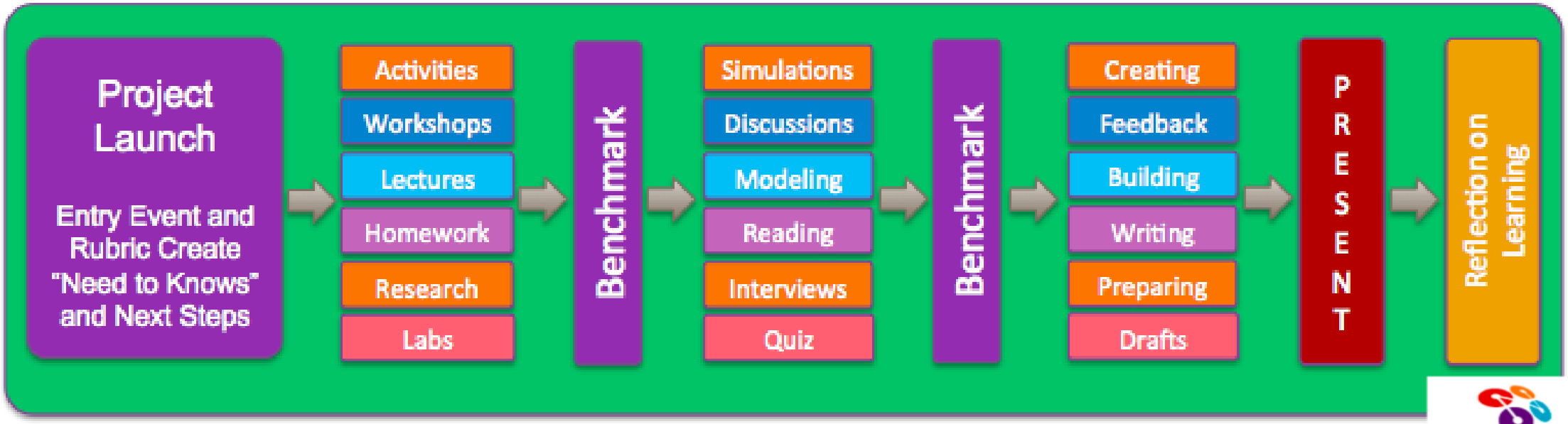
TAKE A MOMENT TO INTRODUCE YOURSELF TO YOUR TABLE MATES AS YOU SETTLE IN.

Traditional Unit With Project:

Lecture → Activity → Quiz → Lecture → Activity → Quiz → Review → Exam → Project

Project-Based Learning Unit:



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ENTRY DOCUMENT

Team,

In the upcoming weeks we are going to compete in a car race. I'll provide the battery-operated cars. You may be worried that I'm setting you up to lose. I could give you an exceptionally slow car and pool my personal resources to secure the fastest car for myself. To make this race fair, I'm changing the rules a bit. Rather than trying to beat my car across the finish line, your goal will be to tie my car. That is, **you want your car to cross the finish line at the same time as mine.** This means you will be competing against me, but not each other.

Even with this new rule, I'm a bit nervous that I'm going to beat all of you. To give you the best fighting chance in this race, your team must demonstrate that your car placement will result in a tie by preparing the following information:

- Your car's velocity
- A graphic representation of your car's position versus time
- An equation that models your car's position as a function of time
- Your car's placement, in relation to the finish line, when we begin our race
- A name for your car.

Once I am satisfied that you have accurately determined the information listed above, each team will have two chances to tie my car. Throughout this unit you will document and save your work in your team portfolio. A more formal summary of the items and important assignments that you must include in your portfolio is forthcoming.

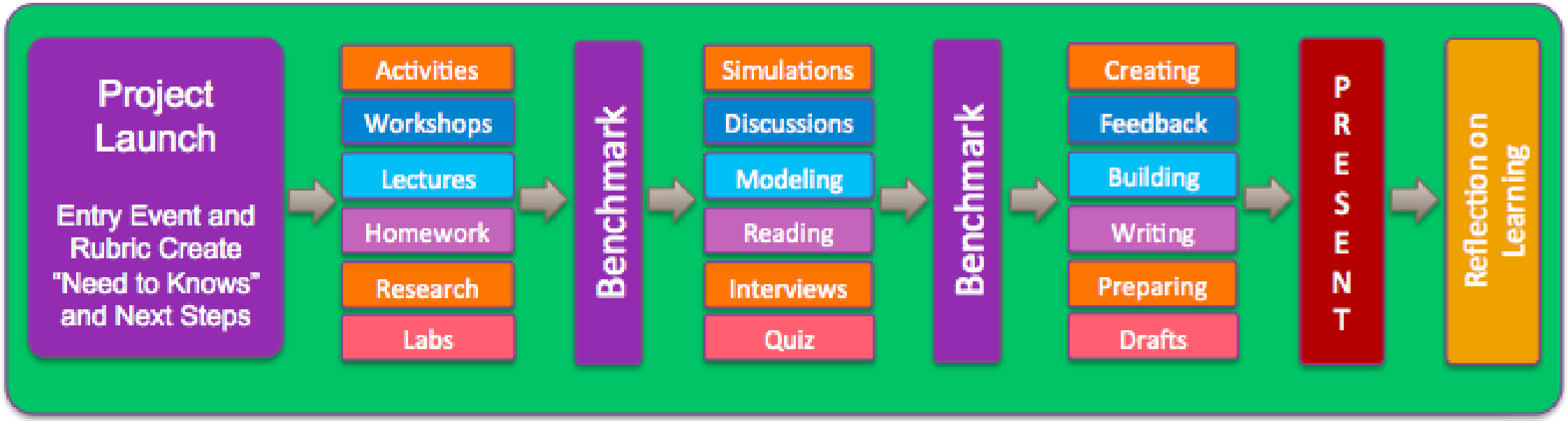
May the odds be in your favor,

Dr. Espinosa

Know	Need to Know	Next Steps

Traditional Unit With Project:

Project-Based Learning Unit:



New Tech Network

NEED TO KNOW: HOW DOES THE PACE CAR MOVE?

1ST BENCHMARK - PACE (TEACHER) CAR DATA

ROLES

- Timer
- Car Wrangler and Measurer
- Taper(s)
- Recorder

NEED TO KNOW: HOW DOES THE PACE CAR MOVE?

1ST BENCHMARK - PACE (TEACHER) CAR DATA

ROLES	DESCRIPTION
• Timer	• Ready, set, go! Then count off every two seconds.
• Car Wrangler and Measurer	• Release the car when indicated by the timer, then measure the distance from the origin line to each piece of tape
• Taper(s)	• Put a piece of tape on the floor at the location of the front wheel every two seconds
• Recorder (and back up taper)	• Record distances on whiteboard

TEACHER PACE CAR DATA

Time traveling (seconds)	Distance from origin line (cm
2	48.5
4	86.9
6	131.7
8	172.6
10	211.2

BENCHMARK ACTIVITY #2:TEAM TASK (15 MINUTES)

- Assign each team member a role (timer, taper(s), car wrangler/measurer, recorder)
- Follow the instructions on your team handout to determine the direction and distance your team's car should travel in relation to the "origin line"
- Create team poster (timer and taper lead this). Your poster must include:
  1. A table of values with two columns (time and your car's trial #1 position)
  2. A graph representing your car's trial #1 position from the origin line versus time (on the time axis, scale 2 inches = 1 second, roughly)
  3. An equation that models your car's distance from the origin line as a function of time (if you were able to create it).
- Answer #5 from handout – this doesn't need to be on the poster.

Procedure:

1. Find a clear 2-meter area and mark the origin line on the floor with a piece of masking tape. Label the origin line.
2. Decide whether you will place tape on the floor in 1 or 2 second increments. Fill in the time column (below) based on your decision. All team members should do this on their paper.
3. **Follow the directions on the blue slip of paper** to determine where to start your car in relation to the origin line and the direction that it should travel. Place a piece of tape on the ground at the starting point and label it. Note that your blue slip of paper indicates your group letter. Write your letter on the top right corner of this page. All group members should do this.
4. The **car wrangler** should hold the car in the air above the start line and turn the car on. The front tires of the car should be hovering over the start line. DO NOT hold the car in place on the floor while it is turned on.
5. The **timer** should count down to when they start the stopwatch so that the wrangler releases the car when the stopwatch begins. The timer should count out loud in the agreed upon time increment.
6. The **taper(s)** should place a piece of tap beside the front tire of the car when indicated by the timer. Mark at least five locations.
7. Once at least five locations have been taped, the **car wrangler** should measure in centimeters the distance of each piece of tape from the ORIGIN LINE (not the start line).
8. The **recorder** should record these measurements in the trial #1 column of the table below.
9. Complete steps 4-7 again, but this time the **recorder** should record these measurements in the trial #2 column.
10. All team members should average the distances from trial #1 and trial #2 and record the average distance on their own paper.

BOARD MEETING

- Arrange yourselves in a large circle. Everyone must be standing on the perimeter of the circle. **Recorder** and **car wrangler** must hold your team's poster.
- First two minutes are always silent (we'll limit to one min.) Look at the other whiteboards and think about:
  - What do you notice?
  - What do you wonder?

BOARD MEETING QUESTIONS

- Why do some lines look steeper than others?
- Whose car started the farthest from the origin line and how can you tell?
- Whose car traveled away from the origin line and how can you tell?
- Whose car went the fastest? How can you tell?
- How can you determine the starting point by looking at the graph?
- How can you determine the starting point by looking at the equation?
- How can you determine whether they traveled toward or away from the origin line by looking at the equation?

CAR RACE!

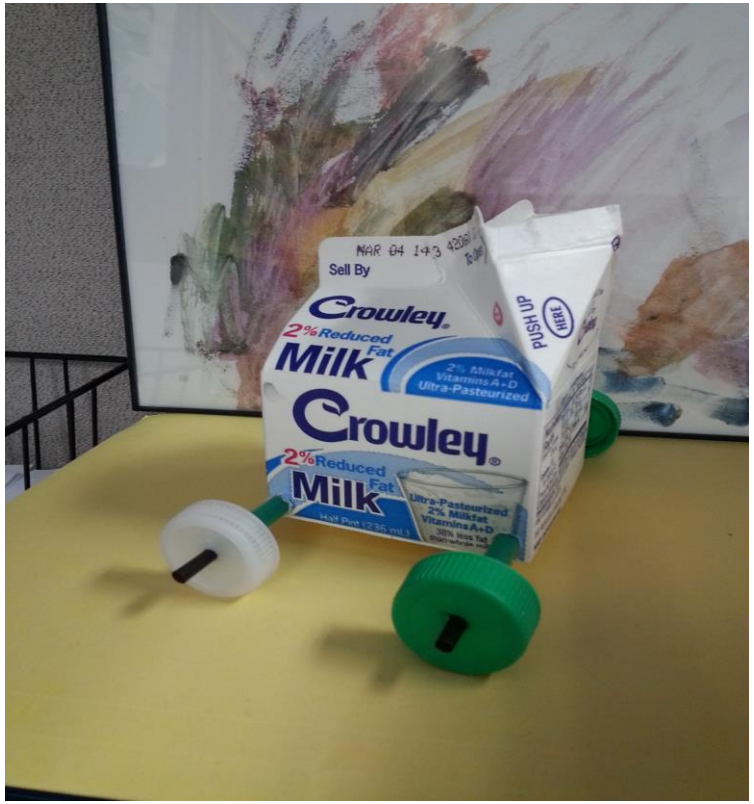
- But first –clumsy teacher error
  - Motivates reiteration and reworking (“they need more practice”)
  - More exciting than an extra worksheet/warm-up
  - Opportunity to assess students that are on your radar

- Place your car your calculated distance from the finish line, and get ready to start your engines (#5 from 2nd handout).

PROJECT EXTENSIONS

GRAVITY CARS – QUADRATICS & PIECEWISE

- Design and build a car that travels down a ramp.
- Pace car travels on the floor beside the ramp
- Goal is to determine where to position car on the ramp to tie my pace car at the bottom of the ramp.
- Piecewise extension: Move the finish line away from the bottom of the ramp so that the gravity car's position versus time isn't entirely quadratic.



PARAMETRICS CARS (DAVID KALB YOUTUBE)

Time (seconds)	Horizontal Position (cm)	Vertical Position (cm)
.034	21.85	140.4
.101	61.29	155.1
.187	96.68	161.8
.302	171.5	156.4
.336	189.7	150.2
.369	208.4	143.7
.402	226.4	134.4
.469	262.0	112.9
.502	279.4	98.22
.536	297.0	82.75

PROJECT GOAL

- Place a constant velocity car directly under the projectile launcher.
- Determine when you need to release the projectile launcher so that the ball hits your car.

REFLECT!

- Consider popular frameworks for effective teaching and learning (CCSM Math Practices, NCTM Process Standards, NCTM Principles to Action, MAA instructional practices guide, etc).
  - How does this project align with these frameworks?
  - What practices, process standards, PtA does it motivate?
  - What activities are you already teaching that also motivate these practices?
- How can you scaffold this project to make it more accessible and better support student learning?

- CCSS-M Practice 4: Model with Mathematics
- NCTM Process Standard: Representation
  - create and use representations to organize, record, and communicate mathematical ideas;
  - select, apply, and translate among mathematical representations to solve problems;
  - use representations to model and interpret physical, social, and mathematical phenomena.
- PtA: Use and connect multiple representations
  - Effective teaching of mathematics engages students in making connections among mathematical representations (physical, verbal, symbolic, etc) to deepen understanding of mathematics concepts and procedures and as tools for problem solving.

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KNOWLES TEACHING FELLOWSHIP OVERVIEW

FINANCIAL SUPPORT

Knowles Teaching Fellows are eligible to receive more than $50,000 in stipends, PD grants & classroom material grants over the course of the five-year program.

COACHING & MENTORING

Knowles Teaching Fellows are supported by experienced teachers who assist with a wide range of personal and professional challenges faced by beginning teachers.

COMMUNITY MEMBERSHIP

Knowles Teaching Fellows are able to tap into a national network of more than 500 teachers who support one another in their efforts to improve education.

KNOWLES TEACHING FELLOWSHIP ELIGIBILITY & APPLICATION

To be eligible for a 2024 Knowles Teaching Fellowship, individuals must:

- have the capacity and determination to **commit to teaching as their primary career;**
- have **earned a degree in a major related to the mathematics or science discipline they intend to teach between 2014 and September 1, 2024;**
- have **earned or will earn a valid state teaching credential/ certificate/license** that enable them to **teach mathematics or science in grades 9–12 in the United States no earlier than January 1, 2019 and no later than September 1, 2024;** and
- be entering their **first, second, or third year as teacher-of-record during the 2024–2025 academic year.***

** For the purpose of eligibility, we consider an applicant's first year of teaching to be the first year in which they teach full time for the full academic year as the teacher-of-record.*

Visit www.knowlesteachers.org/apply to learn more

New high school math and science teachers who are striving to provide equitable instruction are encouraged to apply for a 2024 Knowles Teaching Fellowship.

Questions:
apply@knowlesteachers.org