21st Century Assessment & Differentiated Learning

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Presenter: Jon Bender

Director of Curriculum Development

PCS Edventures, Inc.

Jon Bender

PCS Edventures: What do we do?

We make children's lives better through engaging educational experiences.

PCS Edventures: What do we do?

Our Mission

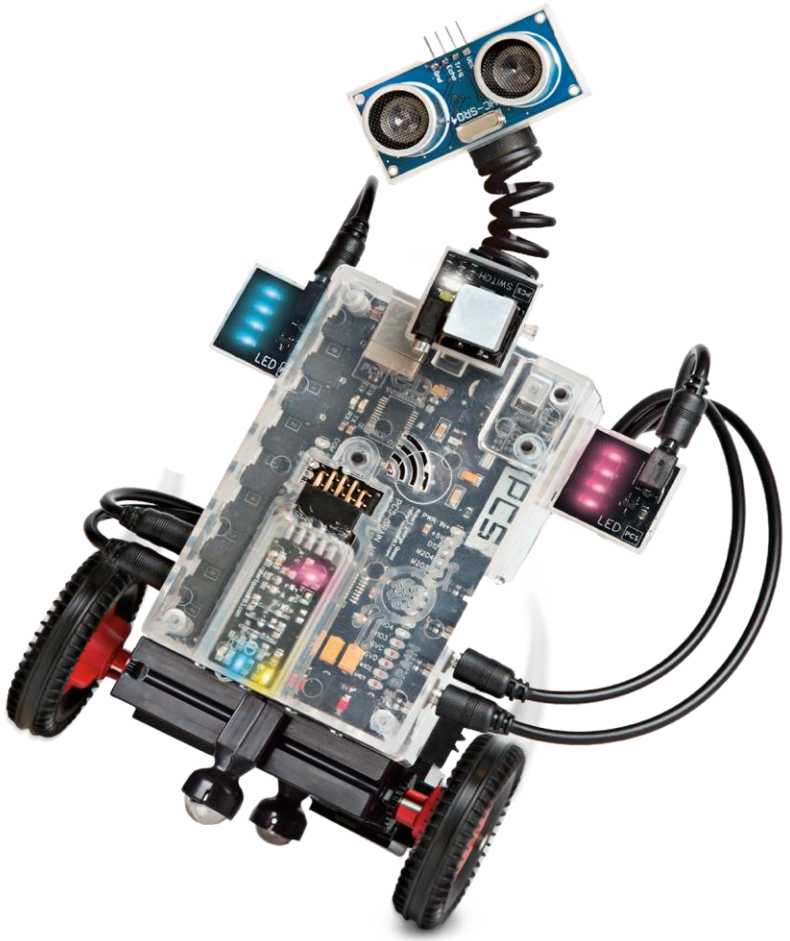
Improve the lives of 10,000,000 children per year with what we do.

- Leader in K–12 robotics education
- PCS STEM products in every elementary classroom
- Establish a global network of Edventures Labs
- Build a virtual community of experiential learners

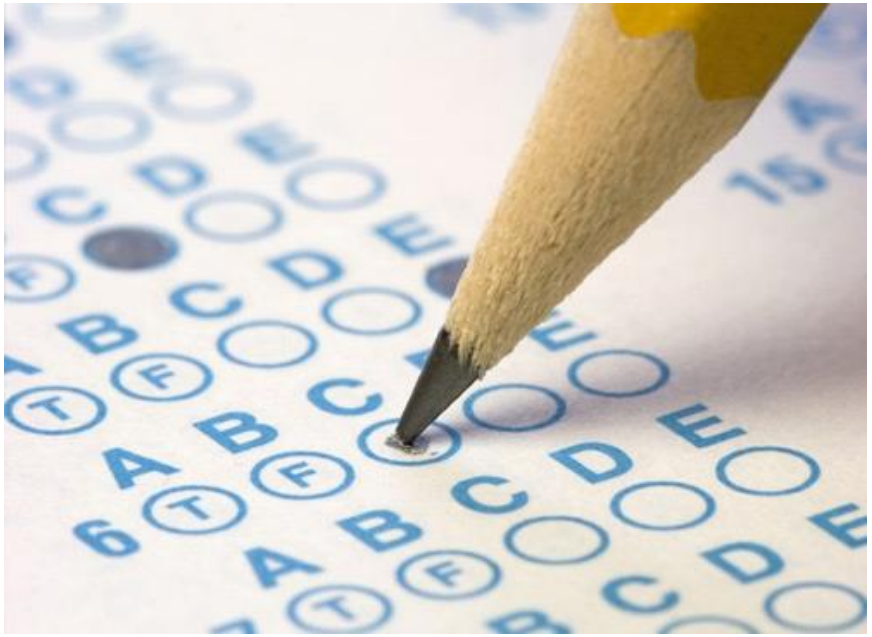
.

What's to come?

- Traditional Assessment
- Process Assessment
- Objectives-Driven Curriculum + Assessment
- Journaling & Portfolio
- Project-Based Learning (PBL)
- Pedagogical Needs
- Curriculum Solutions
- Winner of 1 set of LABCards!



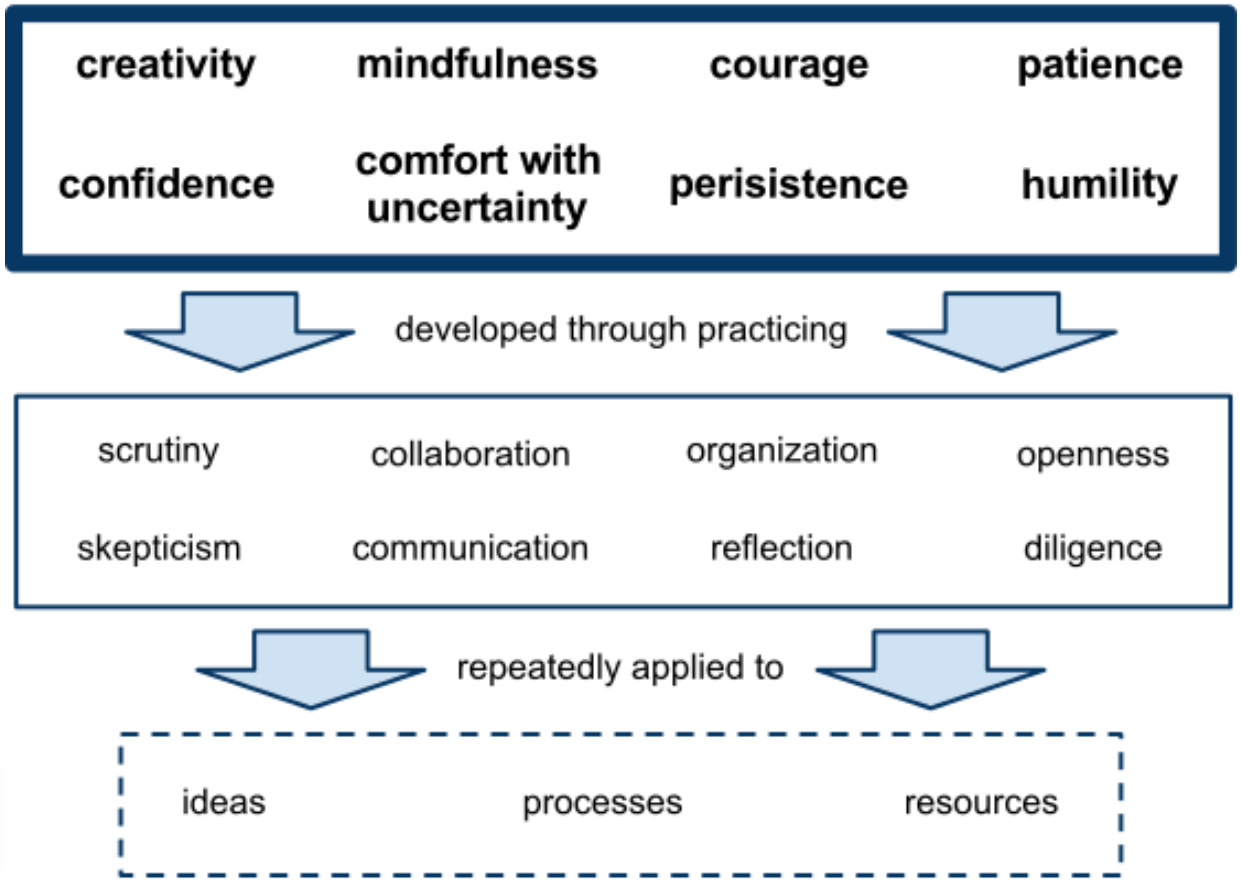
Traditional Assessment



Benefits vs. Drawbacks

Process Assessment

Development



Process Assessment

Implementation

Status Rubric (how am I doing *now*?)

Skill/Character:	beginning	developing	succeeding
academic persistence - what do you do when you're frustrated? Do you independently pursue understanding?	I tend to try one or two things. I give up more easily than I should	I try to stick with things, but I sometimes feel unsuccessful. Sometimes I seek new approaches to help.	I look for **new ways to think** about a problem. I find a way to **persist** despite obstacles
intellectual courage - how do you respond to uncertainty? What do you do when you're feeling overwhelmed (which can be scary)? Do you take intellectual risks?	I don't like to try things unless I'm reasonably certain what the outcome will be	I take some risks, but I sometimes miss out on good opportunities	I make a decision to **trust** that I'll learn something from each experience, even if I'm unsure at times.
mental resourcefulness - where do you turn for ideas? Are you *open* to new ideas? Do you look for connections between ideas? Do you apply past experiences to new situations?	When something seems unfamiliar, I often assume it's not useful.	There have been times when I disregarded new ideas before considering them fully. I don't often see connections between what I'm doing and what I've done	I always try to consider ideas and sources, even if they seem odd or surprising at first. I often **relate** new ideas to old ones.
communication – can you clearly convey an idea to someone else?	It seems like others don't understand what I'm	I can usually convey my ideas, but often, others don't seem to	When I'm not feeling understood, I **search for new**

Process Assessment

Individualized Learning

Progress Rubric (how am I *growing* as a learner?)

Skill:	beginning	developing	succeeding
identification - do you recognize when something about your behavior and methods needs to change?	some of the time. I don't take the time to think about what happened or what is happening much	most of the time. I'm generally reflective and like to prevent problems from recurring	almost every time. I'm in the business of growing and learning from mistakes. **When something goes wrong, it's an opportunity to learn and grow.**
implementation - when you've recognized an area that requires attention, what do you do?	I sometimes dismiss or ignore it for a while, hope it goes away by itself, or think "I should really do something about that"	I tell myself what needs to happen, and think of some ways to get it done.	I create a plan with **concrete steps**, then proceed to get organized. Later, I check in to see that I'm following the plan.
consistency - once you have made an action plan for change, one that will work, how long do you stick to it?	Maybe a week at most. Habits are nearly impossible for me to change.	I can usually keep it up for a while, but then my efforts start to dwindle	I'm pretty good at making change stick, though I might modify (improve) the plan as necessary. When I **commit to something, I mean it**
connections - when you want to change your habits, do you enlist the support of your community?	I tend to go it alone	I sometimes tell people about what I'm working on	I keep people informed as I go about the very difficult job of making positive changes. When possible, I **ask others for support**.
frequency - how often do you evaluate your growth as a learner?	rarely	about every couple of weeks	at least weekly
self-compassion - when you're having trouble making a change, what do you do?	I often feel like giving up. small setbacks can have a big impact on me	I try harder, in hopes that I can do better	I **modify my approach** and/or **seek resources** to support my success. I recognize that change is difficult and that small/incremental progress is worth celebrating

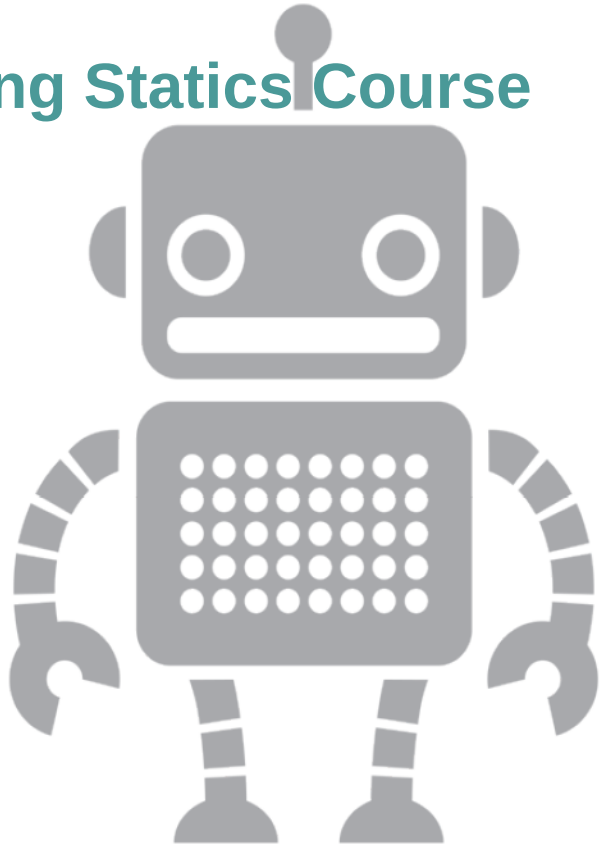
Logistical Constraints

Mastery Assessment

College Engineering Statics Course

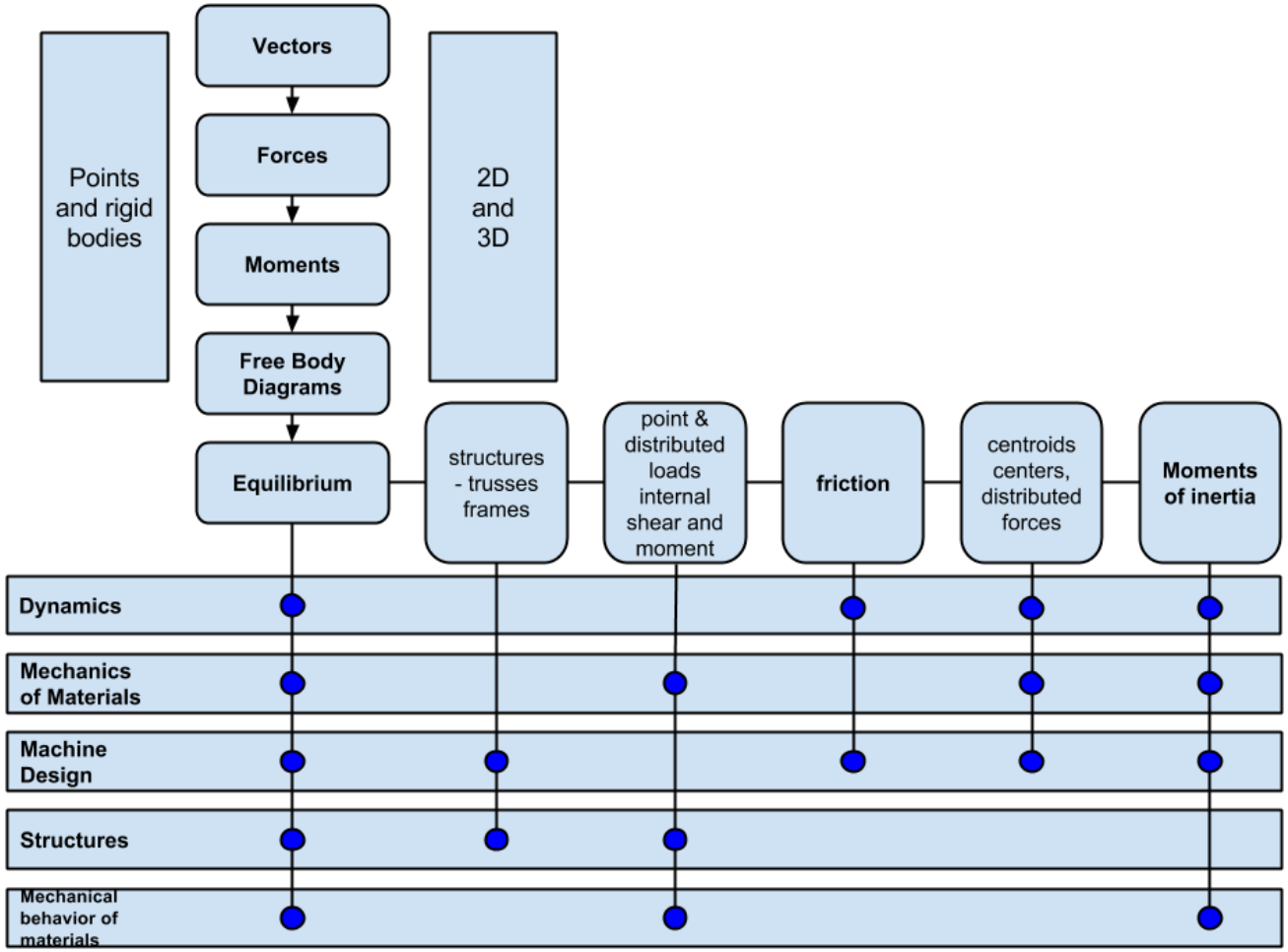
Content Mandates

Large class size



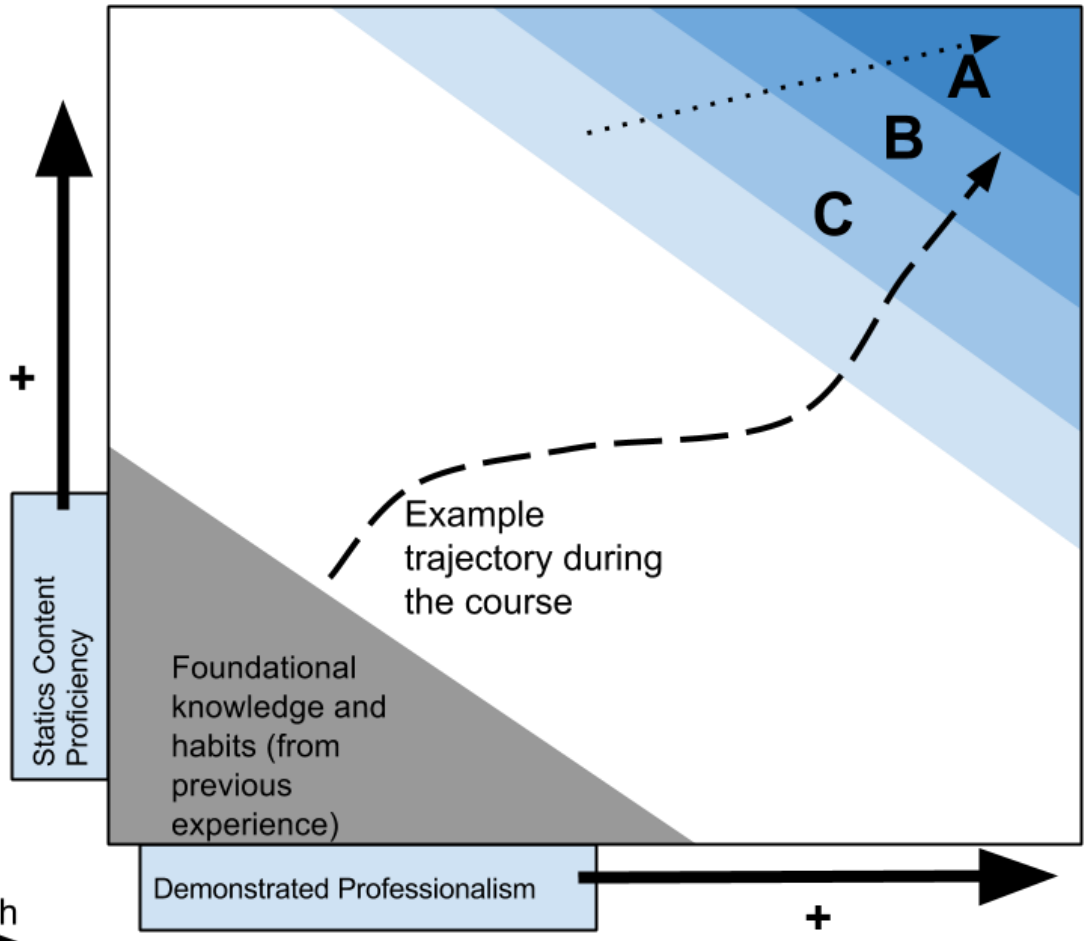
Mastery Assessment

Course Structure



Mastery Assessment

Learning arc



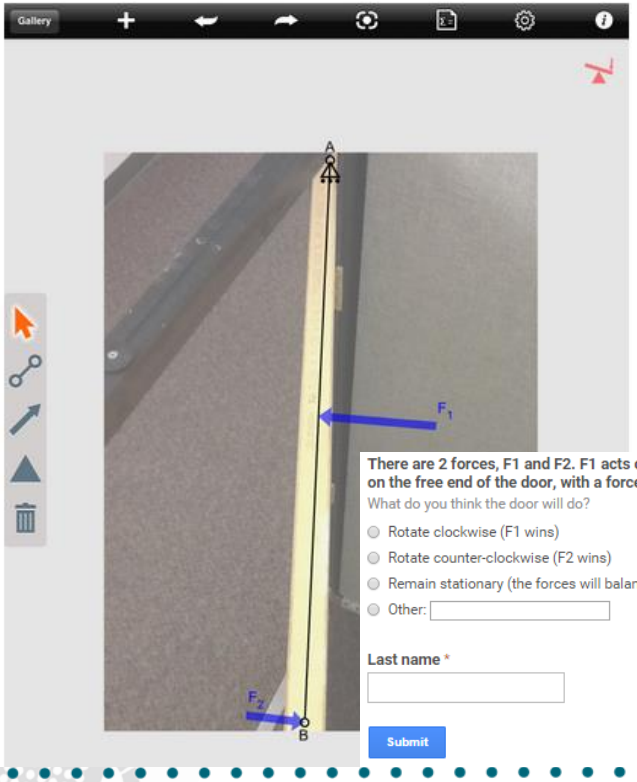
Mastery Assessment

Pre assessment

The moment of a force 1

* Required

This door is typical, with hinges visible. You are looking down from the top (imagine directly down, I wanted the hinges visible so I actually took the pic at an angle)



There are 2 forces, F1 and F2. F1 acts on the middle of the door with 100 lb of force, and F2 acts on the free end of the door, with a force of 50 lb. *

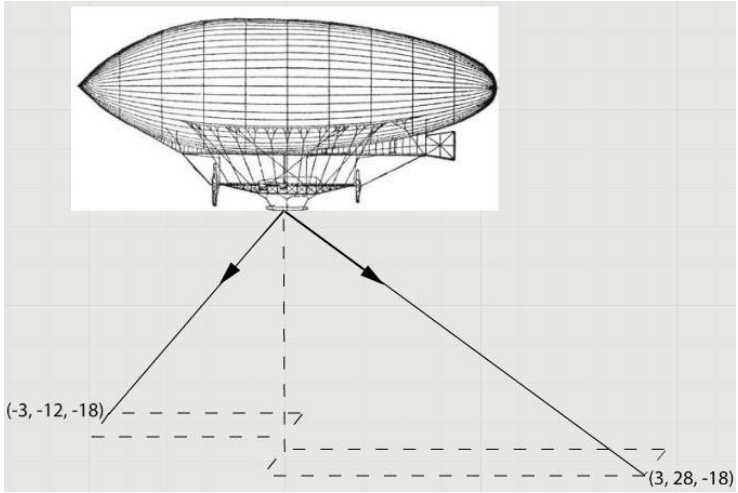
What do you think the door will do?

- Rotate clockwise (F1 wins)
- Rotate counter-clockwise (F2 wins)
- Remain stationary (the forces will balance)
- Other:

Last name *

Submit

Assessment



____Vector notation

____2D vector addition

____3D vector addition

____Equilibrium (forces)

____Unit vectors

Objectives-Driven Curriculum & Assessment

NEXT GENERATION SCIENCE STANDARDS

For States, By States

The Common Core concentrates on a clear set of math skills and concepts. Students will learn concepts in a more organized way both during the school year and across grades. The standards encourage students to solve real-world problems.

COMMON CORE STATE STANDARDS INITIATIVE

PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER

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Project Instruction (PBL)

- Inherently Process-heavy
- Intrinsic “natural” feedback
- Authentic

Pedagogy

ITERATIVE DISCOVERY
ENGINEERING PROCESS

TRIAL & ERROR

ACADEMIC ANALYSIS

MOST EFFICIENT

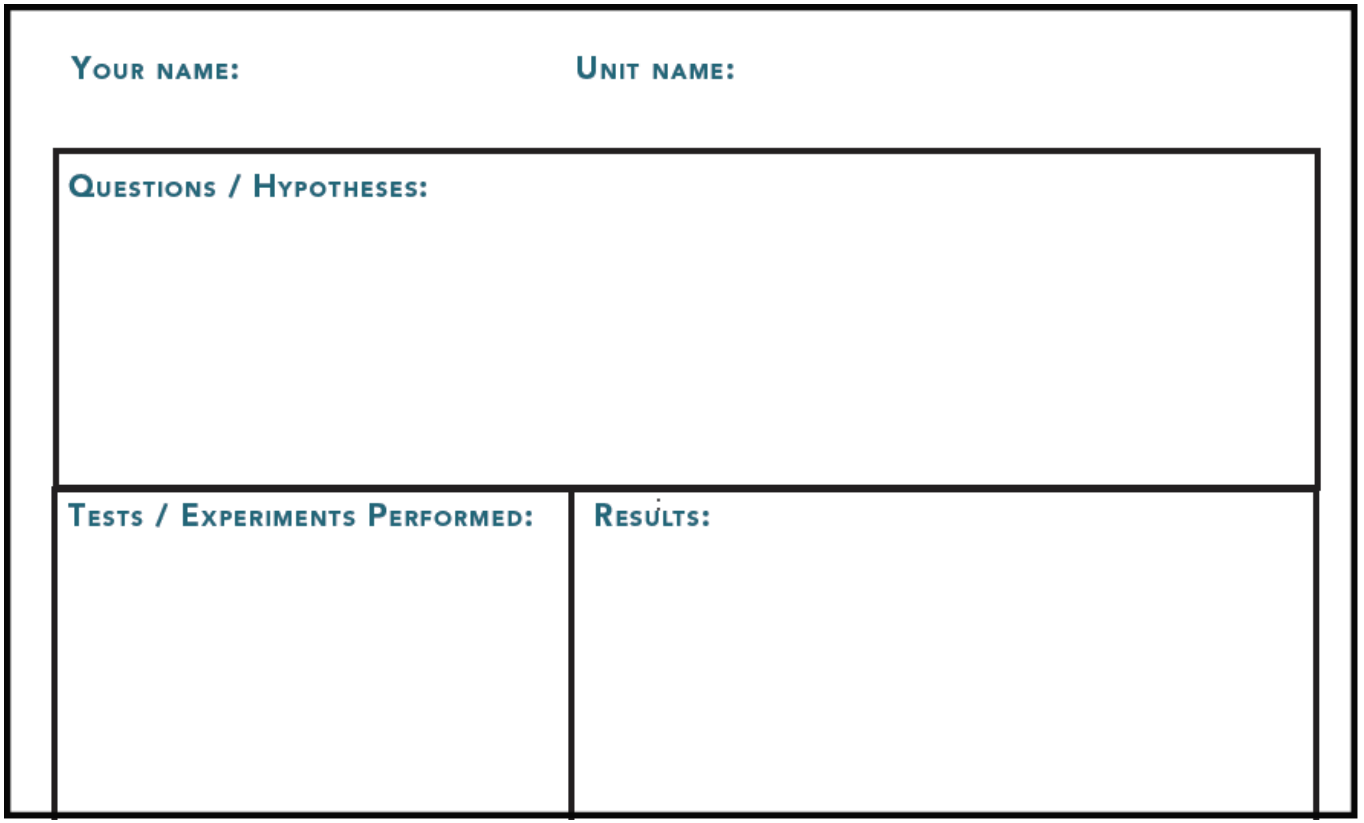
JOURNALING & REFLECTION

Rationale

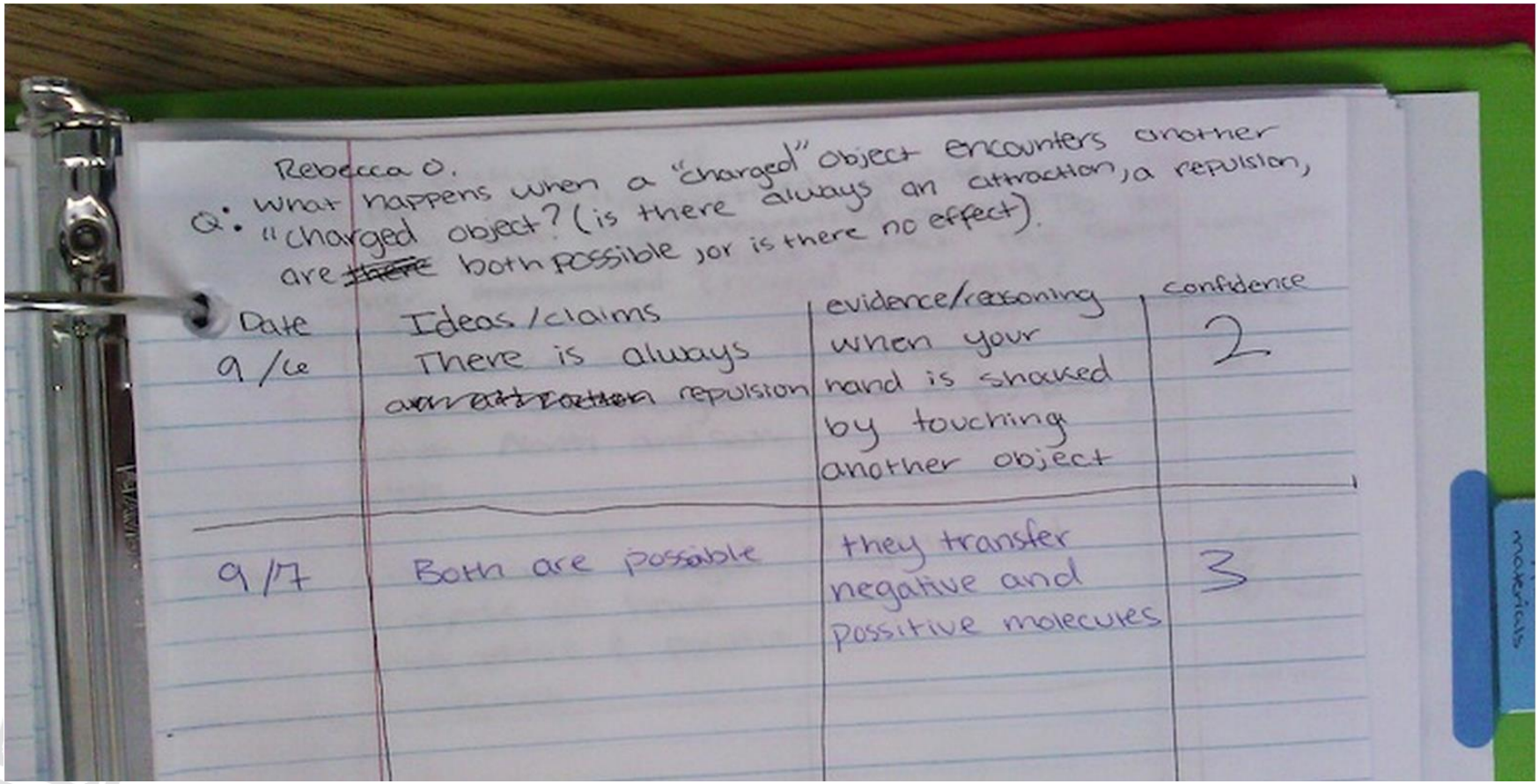
Reflection is another means of adding value to a learning experience. Both content and meta-level insight are available through the process of evaluating your work after it has been done. We recommend that journaling be a central and significant part of this curriculum. Our journal structure is by no means the only one that accomplishes the goals of reflection; we provide it as a default—a starting point. If students are already journaling in the classroom, we encourage modification to our prompts and categories to fit into the existing structure.

Journaling and Portfolio

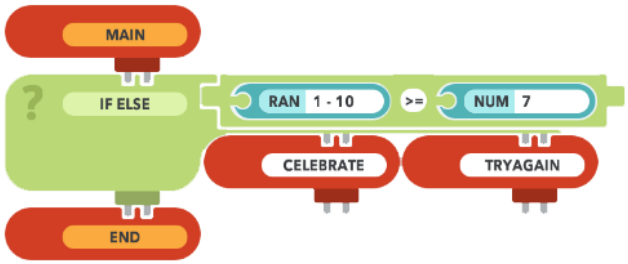
- Varying degrees of management and control
- Authentic accountability is best

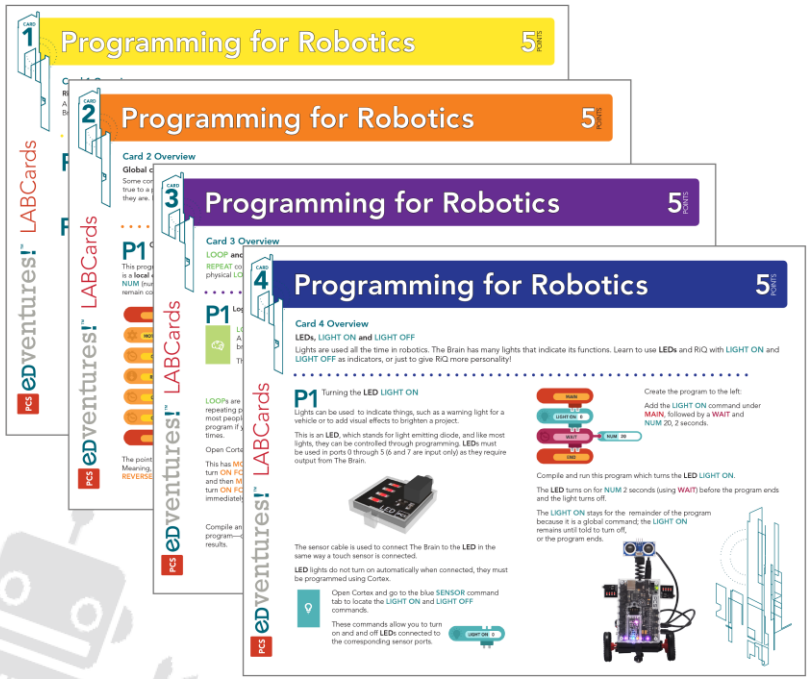


Journaling and Portfolio



Discover Robotics





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Example Project

LEVEL ONE SCHEDULE

- Project 1: Build and Program a Motor Test Station
- Connect It
- Challenge 1: Create 3 Programs
- Reflect
- Project 2: This Way/That Way
- Challenge 2: This Way/That Way
- Reflect
- Personal Project: Computational Multitasking
- Reflect
- Key Concepts

Project 1

Build and Program a Motor Test Station

In this project students build a **DC motor** testing station, connect everything properly and identify all **ports** and **cables**. Also begin writing the first set of commands in Cortex.

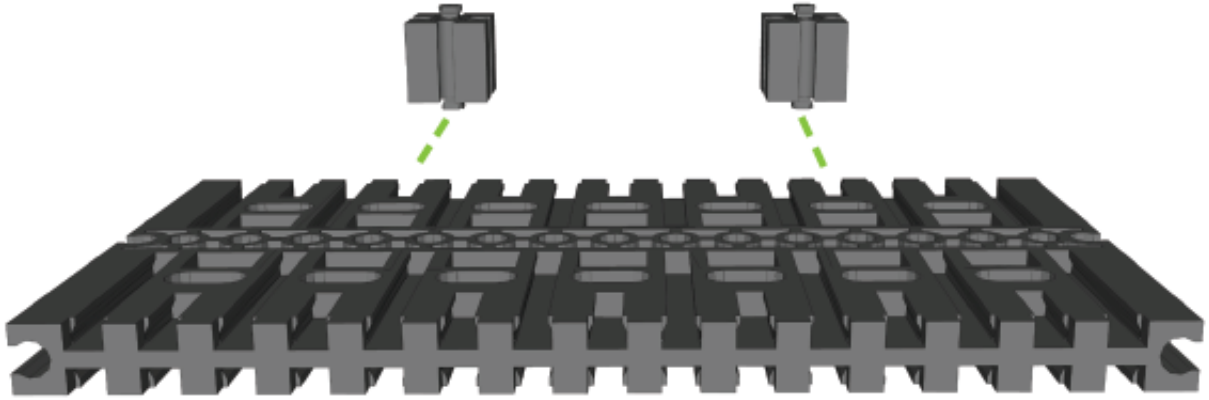
Example Project

1

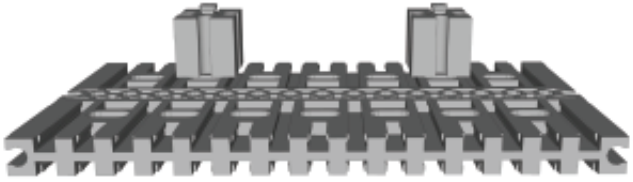
x1

x2

All steps have an "exploded view" which helps with assembly.



The assembly should look like this before proceeding to the next step.



Example Challenge

Challenge 1

Create Three Programs

Using your motor testing station, create three separate programs to do the following:

Program 1: Make motor A run for 10 seconds and motor B run for 5 seconds.

Program 2: Make motor B run for 5 seconds and then reverse for 8 seconds.

Program 3: Make motors A and B run simultaneously for 5 seconds and then reverse simultaneously for 5 seconds.

Adjust the value of NUM so that the wheel spins around exactly 3 times and stops where it started.

Try the same challenge for motor B. Is the value that you used for motor A lesser (<), greater (>) or equal (=) to the value used in motor B for the same result? Explore the answer in the next challenge.

Example Personal Project

LEVEL 1: Programming for Robotics

Personal Project

Computational Multitasking

Computers are great at following instructions; often better than our own bodies. Program four different motors to do four different things, but have them all run at the same time. Decide what four actions to program the motors to do. Here are the requirements:

1. Add two more motors to the motor testing station.

   a. Decide how to connect them to the baseplate and be sure all motors are facing the same direction so that you can see how they run differently or the same.

   b. All motors should be plugged into the **ports** and named A, B,C and D.

2. Before actually writing the program, predict exactly what you would like to happen to each motor (record the goals in your journal).

   a. You must demonstrate the appropriate use of each command you learned about (**MOTOR**, **REVERSE**, **THIS WAY**, **THAT WAY**, **SET PWR** and **ON FOR**).

This project requires that students combine groups and use two kits (so they'll have four motors). You may have them simply take turns using the motor sets, but write individual codes in Cortex.

Example Extension

Extension

1. Using a stopwatch and 60cm line previously measured and marked with tape, calculate the **speed** of your **robot** at maximum power (remember that one motor will probably need to run with less than 100% to get a straight line).

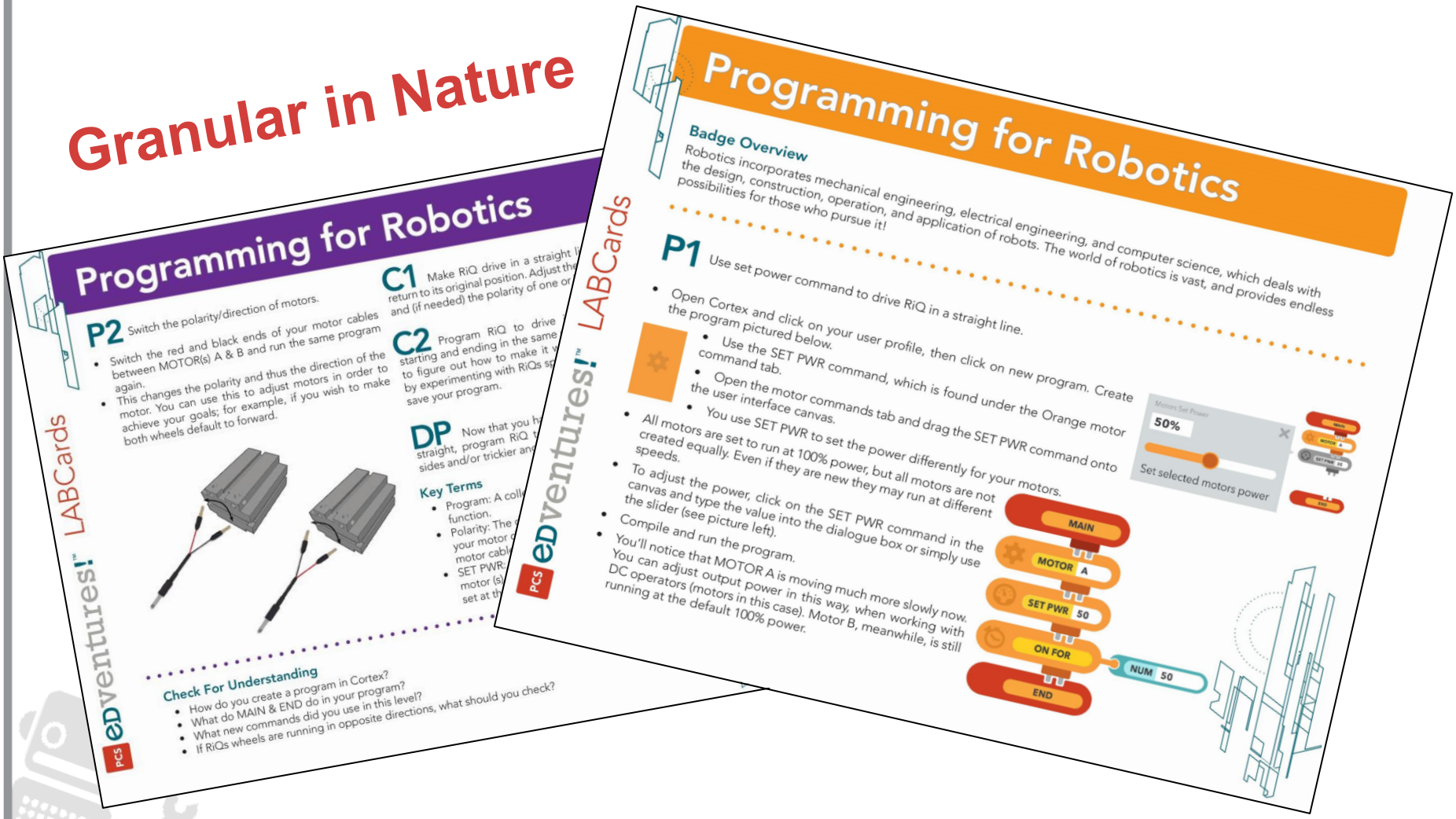
   Speed = Distance / Time

2. Once you have decided on a method of figuring this out, share it with at least one other group. The goal is to agree that your method, and theirs, work. Do not calculate the **speed** until you are confident of the method (at least an 8 out of 10 confidence).

*For this activity, produce a table on a board in the front of the room where each group can post their speed. The purpose of this extension is to discuss sources of error, comparing random (e.g. motor variability) vs. **systematic** (e.g. measurement/ precision error). Secondarily, this will provide some exposure to the inherent variability of the mechanical elements of their robots. They will refer to this later when they explain some of the difficulties that they might encounter with the more advanced programs.*

LABCards

Granular in Nature



LABCards: Familiar Point System

OUTLINE

Programming for Robotics

5 POINTS FOR EDP

Yellow Level Overview

Robotics incorporates mechanical engineering, electrical engineering and computer science - all of which deal with the design, construction, operation and application of robots. The world of robotics is vast and provides endless possibilities!

Robotics Level 1 introduces the hardware used for RiQ including The Brain microcontroller and DC motors. Program The Brain and RiQ using the Cortex programming environment in the following projects. Learn the basics of motor control through an introduction to the language and logic used by computers.

Skills & Learning Objectives

Card 1: 5 POINTS

RiQ: Introduction to fischertechnik™ and PCS Robotics: The Brain and Cortex

Build with fischertechnik™ manipulatives, start basic programming with The Brain in Cortex software.

Card 2: 5 POINTS

Cortex, New Project, New User, Save and Bluetooth Connectivity

Create a new project and new user as you write and save your first program.

Card 3: 5 POINTS

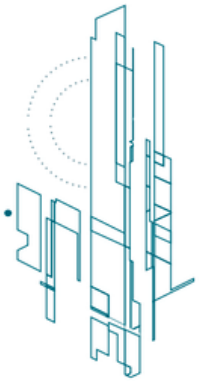
Motor Commands: **ON** and **ON FOR**

Learn motor control and adjust the motors on RiQ.

Card 4: 5 POINTS

Motor Controls: **SET PWR** and **MOTOR** polarity

More advanced motor commands are added to your programming skill set.



End Design Project / EDP * 5 POINTS

Now that you understand basic motor control, demonstrate your mastery by programming RiQ to draw a recognizable shape using the Engineering Design Process; plan your program, test and modify until it works. The only criteria for your drawing is that a peer or instructor can look at the shape and quickly identify it!

** After completing the skills and activities on cards 1-4, return to this final project to test the knowledge you've gained throughout the yellow level.*

PCS edventures!™ LABCards

LABCards: Overview

- After school programs, libraries, maker spaces, home use, and student-driven classrooms.
- Easy to follow activities push students to expand and create.
- Mastery through incremental concept acquisition

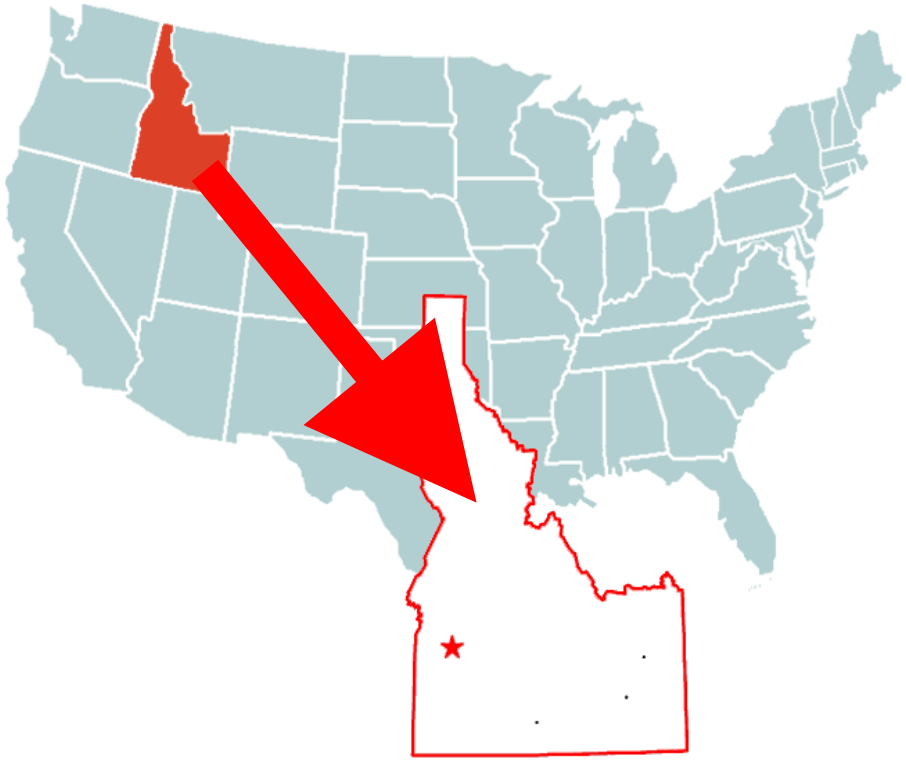
There are limitless opportunities to incorporate new assessment techniques into your different educational programs. Let us help you uncover yours!

Questions?

LABCards Winner!

And the winner of one set of 3D Printing LABCards is…

Where Can You Find Us?



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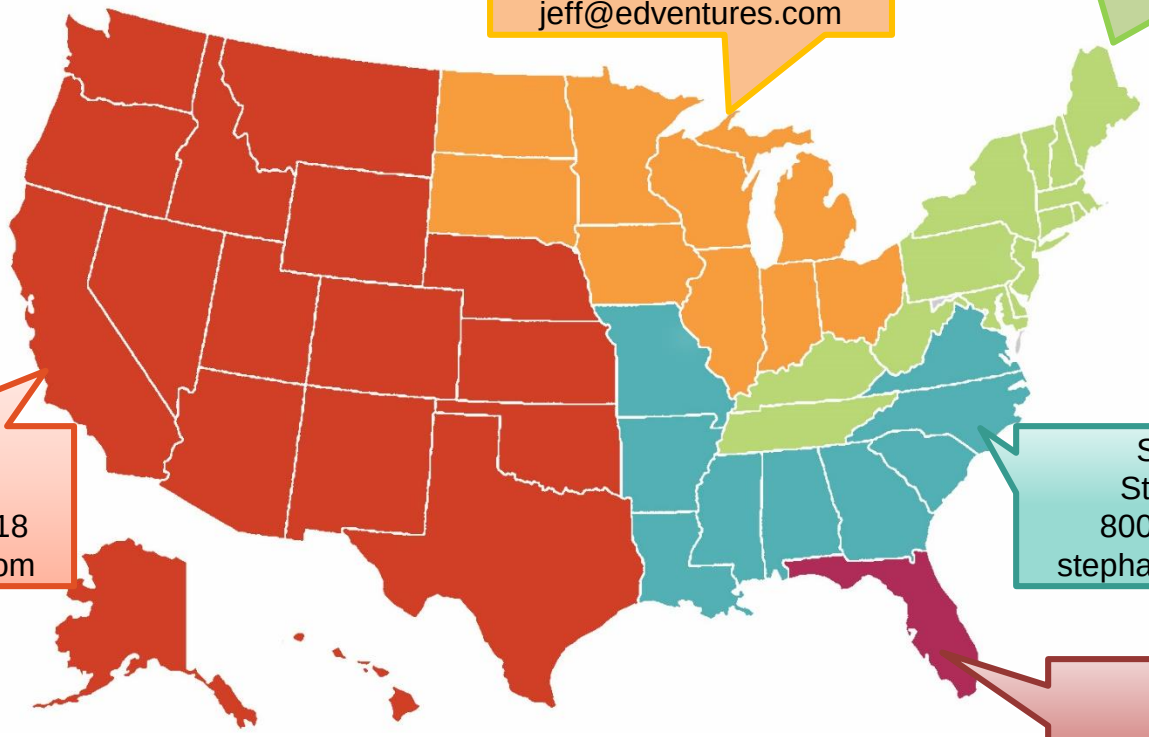
PCS in Your Neighborhood



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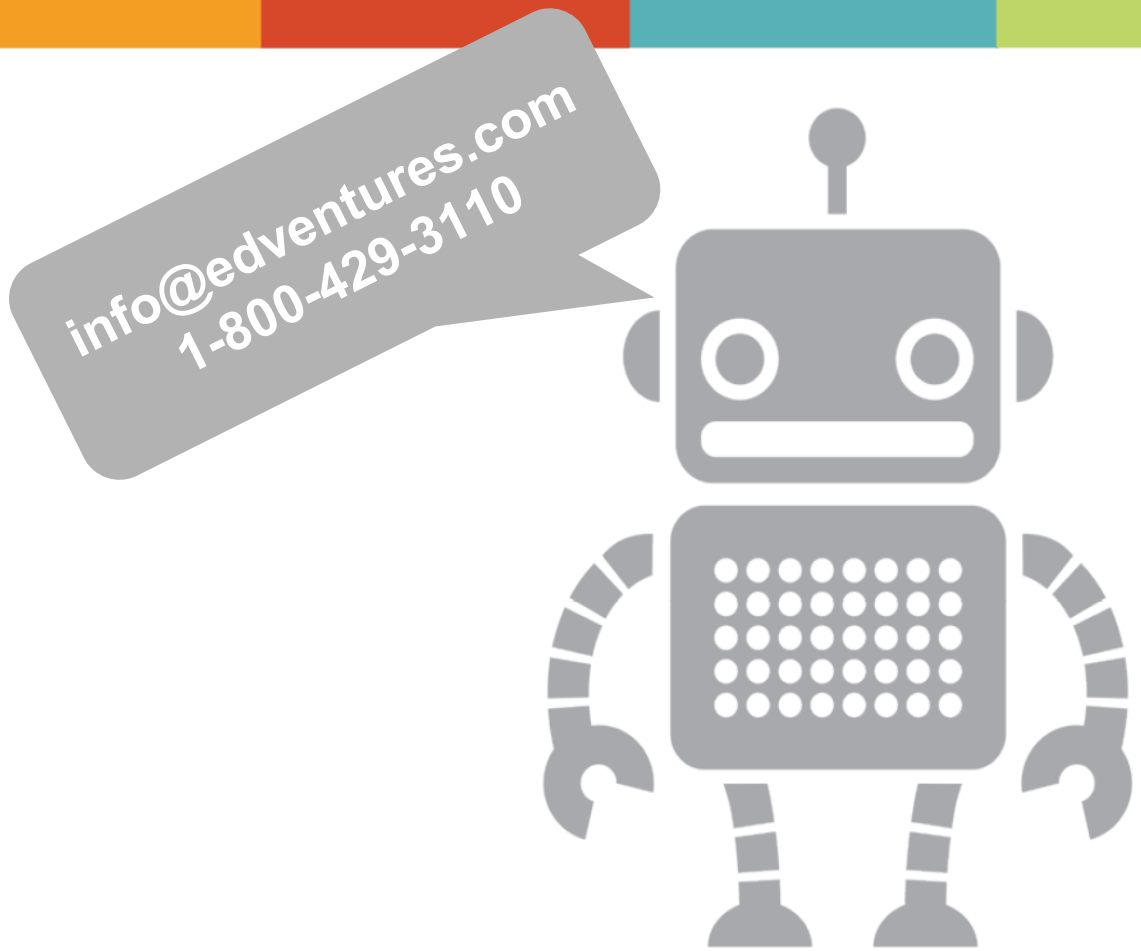

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Thank you!

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