# Navigating Challenges and Alternatives in Physics Education: An Engineer's Perspective

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# What does it look like to ACT and THINK in a Science class?

#### Science and Engineering Practices

Asking questions and defining problems

Developing and using models

Planning and carrying out investigations

Analyzing and interpreting data

Using mathematics and computational thinking

Constructing explanations and designing solutions

Engaging in argument from evidence

Obtaining, evaluating, and communicating information

### Crosscutting Concepts

#### Patterns

Cause and effect

Scale, proportion, and quantity

Systems and system models

Energy and matter

Structure and function

Stability and change

### Disciplinary Core Ideas

Life Science	Earth & Space Science	Physical Science			
From molecules to organisms: Structures and processes	Earth's place in the universe	Matter and its interactions			
Ecosystems: Interactions, energy, and dynamics	Earth's systems	Motion and stability: Forces and interactions			
Heredity: Inheritance and variation of traits	Earth and human activity	Energy			
Biological evolution: Unity and diversity		Waves and their applications in technologies for information transfer			
Engineering, Technology, and the Application of Science					

### Creating a model of a student in school

#### Vision:

Building a community that inspires curiosity, creativity, and achievement

#### Mission:

Prepare students with the knowledge and skills necessary to be employable and to further their education

#### **Beliefs:**

- Adults should model and promote life-long learning
- Self-discipline is critical to learning
- Assessments are necessary to improve student achievement
- Parents, guardians, and family members are encouraged to collaborate with teachers and school administrators to support student's education

# Student self-regulation is key to their learning process

#### Self-regulation habits supercede academic content in priority

Plan

#### Teacher Led Activity - 5 weeks long

Total Time on Task	Number of Students	
30-40min	37	
20-30min	15	
10-20min	5	
0-10min	3	
		Fvalua

Self Paced Activity - 5 weeks long

Total Time on Task	Number of Students
30-40min	5
20-30min	15
10-20min	20
0-10min	20

### Challenging mathematical skills heterogeneity



 Physics and Math have an extremely high correlation

Plan

- Teaching Physics requires math instruction
- Physics supports both English and Math students' education
- Math is the foundation for logical thinking
- Teach English, Math and Physics

# Teachers set the pace of the implementation cycle

Use a strong welldeveloped curriculum Model and discipline selfregulation habits

Encourage them to **DO Science**  Assessments Daily feedback (grades)

Plan

# Uniform Circular Motion: A curriculum for your student

Plan Evaluate

#### Giancoli Textbook



1. Choose the point at which you want to determine the direction of acceleration and draw velocity vectors at equal distances before and after the point.



2. Place the  $\vec{v}_i$  and  $\vec{v}_f$  arrows tail to tail. Draw a  $\Delta \vec{v}$  arrow from the head of  $\vec{v}_i$  to the head of  $\vec{v}_i$ .



3. The acceleration arrow  $\vec{a}$ is in the direction of  $\Delta \vec{v}$ .







 $a_1 = \frac{\Delta v_1}{\Delta t_1}$ 





# Science Challenge: Real-word applications

Plan Evaluate Implement

#### 2022-2023: School Challenges

#### **School Challenges**

How could exit traffic be reduced? How could bathroom cleanliness improve? How could hallway rough play be reduced? How could lunch food improve? How would school workload be more fair? How would school have better temperature control? How could schools improve technology performance?

#### **Improvement Workshops**

How to improve my time management? Sleeping science Best studying practices The science of motivation

#### 2023-2024: Rubber band Car Challenge



# Making it a modern classroom: Feedback and Grades

**KAMI: Public evidence notebooks** 

#### **Sheets: Public self-paced activity tracker**

А	В	С	D	E	F	G	Н	I
Lesson 25	25.1	25.2	25.3	25.4	25.5	25.6	25.7	Quiz
Type of question	Must do	Pivotal	Must do	Must do	Could do	Must do	Could do	Must do
	2/15	2/23	2/26	2/26		2/27		Great Job Q1
	2/20	2/20	2/20	2/21	2/21	2/21	2/22	Great Job Q2
	2/20	2/21	2/22	2/22		2/23		Great Job Q1
								Great Job Q1
	2/21	2/22	2/22					Great Job Q2
	2/21	2/22	2/22					Great Job Q2
	2/26	2/26	2/26					Great Job Q1
Student	2/16							Great Job Q3
Names	2/21	2/21	2/21	2/21	2/21	2/21		Great Job Q2
	2/21	2/21	2/21	2/21	2/21			Great Job Q1
	2/21	2/22	2/22	2/22		2/23		Great Job Q2
	2/14	2/23	2/23	2/23		2/23		Great Job Q2
	2/21	2/21						Great Job Q1
	2/12	2/12	2/12	2/12	2/12	2/12	2/12	Great Job Q3
	2/14	2/22	2/22					Great Job Q2
	2/20	2/20	2/20	2/20		2/20		Great Job Q2
	2/21	2/21	2/21	2/21				Great Job Q2
	Pivotal: Yo	u must work	together a	nd with the f	teacher			
	Must do: You can work together or independently				ntly			3
	Could do: Only if you have extra time							
	Aspire to d	o: Optional	harder prob	lems				

C https://web.kamihg.com/web/viewer.html?state=%7B"ids"%3A%5B"1reWuWXJueLZ0SmcJX17Fk8MPfOcc-0s.. Ô 👓 WCPS 📅 WCPS Employee 🔥 Tuition Reimb 🔥 Course Approval 🧗 Retirement 🧗 Routes to Initial Cer... 📑 Tech ail - Akamine, An... A Kami Tempora... 🕨 27 RubberBand Car Challenge 3HP.pdf ni 🗉 Q - + 110% 2/28 7.1: Large wheels that don't slip on their axles are good for these kinds of cars, they also have to be far enough apart so it is stable and won't tip over. Make it as light as possible as it will make it go farther. Rubber Bord Car Chillenge designs Prototype I Side View

Plan

# 3 minutes of Questions & Answers



### Acknowledgements





Washington County Public Schools

Modern Classrooms Project



### Takeaways

- Use and adapt the **curriculum** for the needs and pace of the students
- Model students to be learners
- Apply the science to their **daily lives**
- Give them feedback and continuously correct them
- Teach them English, Math and Physics





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Plan

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