Step Data, Prediction, and Engineering Design

by Mark Johnston

CREEDS - RET Fall Presentation


Monday – Friday
7:15 - 8:10
7:15 - SIGN-IN / TEAM Mtg.
7:20 - Design TIME
45min BUILD TIME
Program TIME
7:55 - CLEAN-UP
Practice TIME
11/14
Parents
ACE OPEN HOUSE

Who I Am

Mark Johnston, Engineering Teacher

- MBA and BAAS, both summa cum laude; Texas certified in Technology Education, Tech Apps, Business, SPED, 4-8 Core, and now Computer Science (8-12)
- 10 years teaching experience. Currently teaches high school engineering and coaches competitive robotics at Hornedo Middle School
- Founder of West Robotics, Inc., a nonprofit expanding robotics across El Paso
- Independent consultant for VEX/Robomatter; developed content for VEX VR and led national educator trainings. YouTuber with 5k subscribers.

The Challenge

The Question

Why It Matters

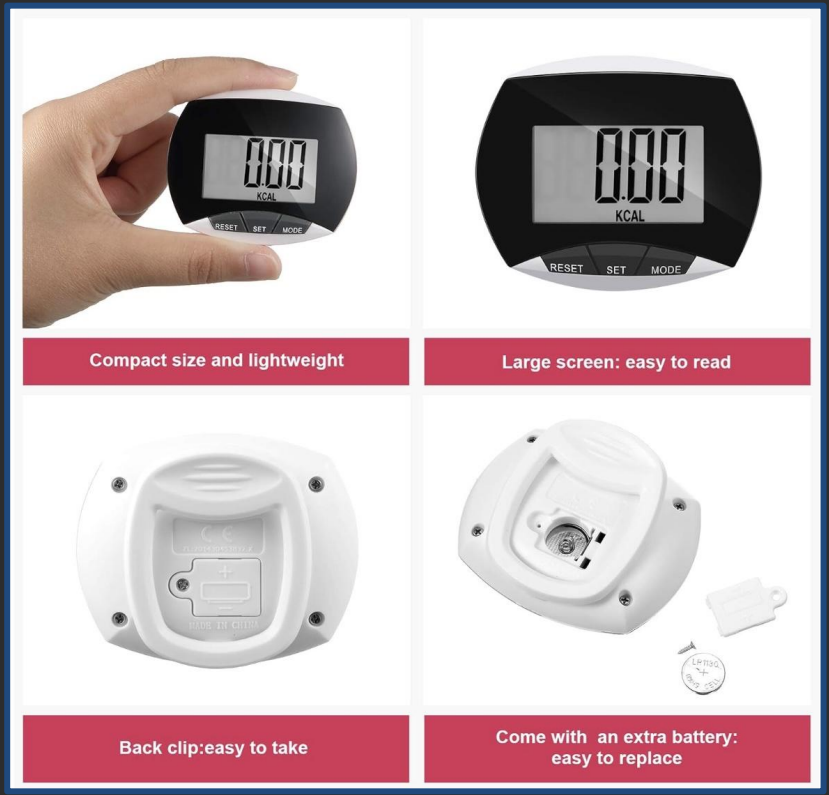
Childhood obesity is more than meets the eye.


1095
STEPS
72


HORNEDO


FIND YOUR GREATNESS.

Equipment


0.00
KCAL
RESET
SET
MODE
Compact size and lightweight
0.00
KCAL
RESET
SET
MODE
Large screen: easy to read
Back clip:easy to take
Come with an extra battery:
easy to replace

The Data


135
3DPedometer
339
NESKLA
Step
102
PM
11:04:11
MODE
SET
RES
3D TriSport
Realalt
STEP
393
PM
11:00
RESET
MODE
SET
PULIVIA
STEP
424
CLOCK
11:01:24
132
PINGKO
1104
3DFitBud
704

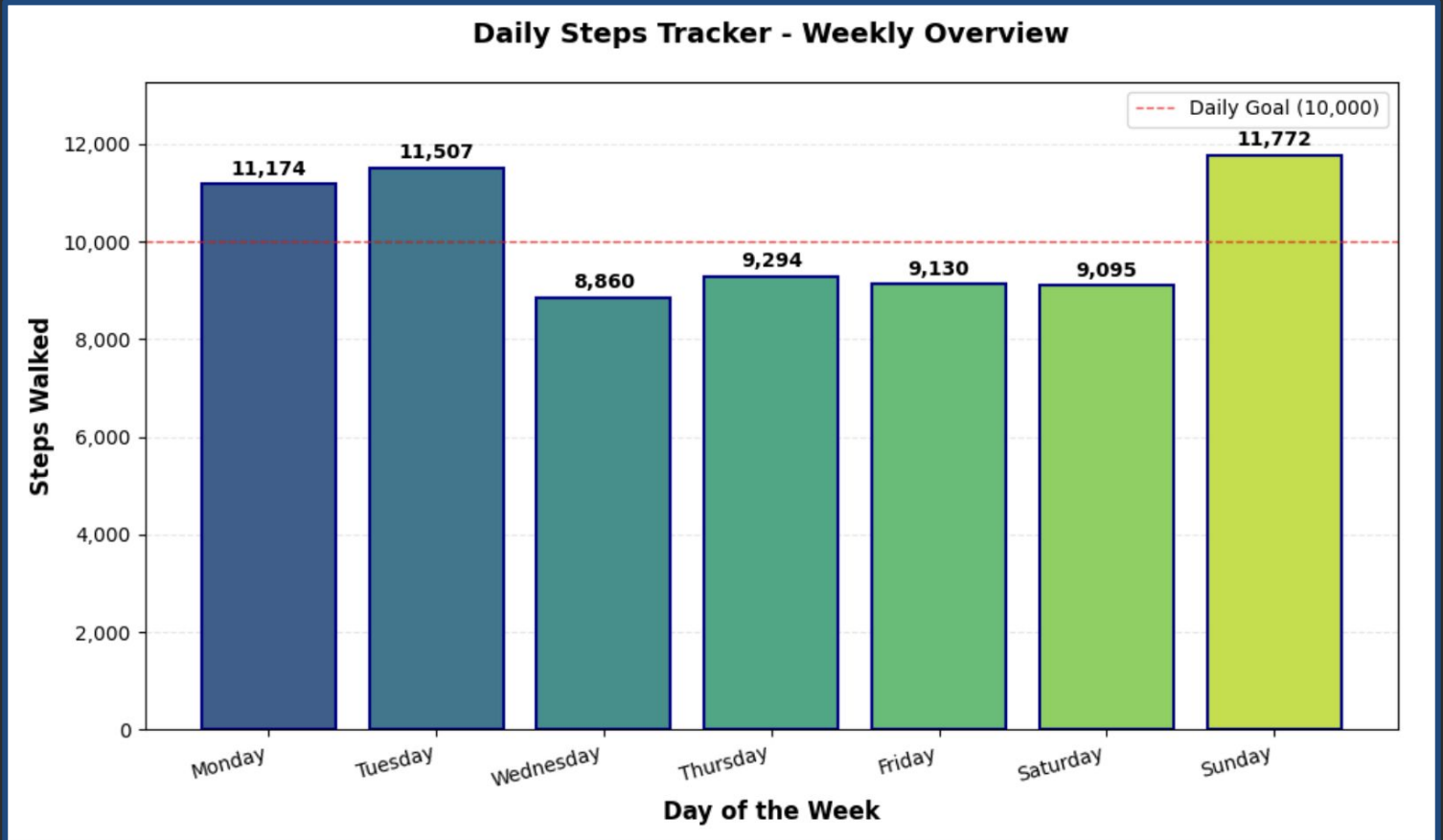
Step 1: Collect

Student Log Sheet

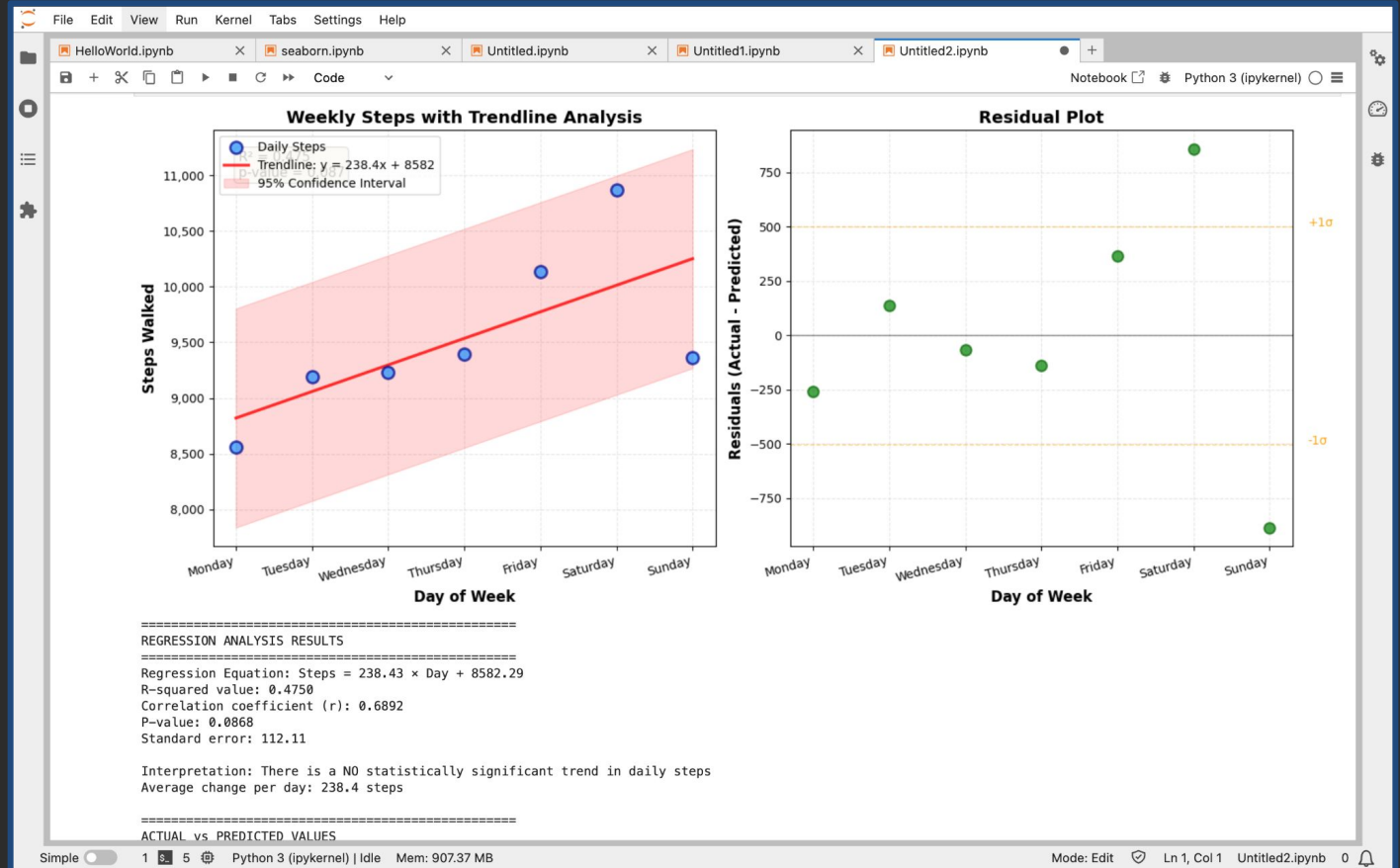
Name: _____ Date: _____

Day	Steps	Initials
Monday		
Tuesday		
Wednesday		

Step 2: Visualize



Step 3: Predict



Step 4: Recommend

StepUp
Health Consulting

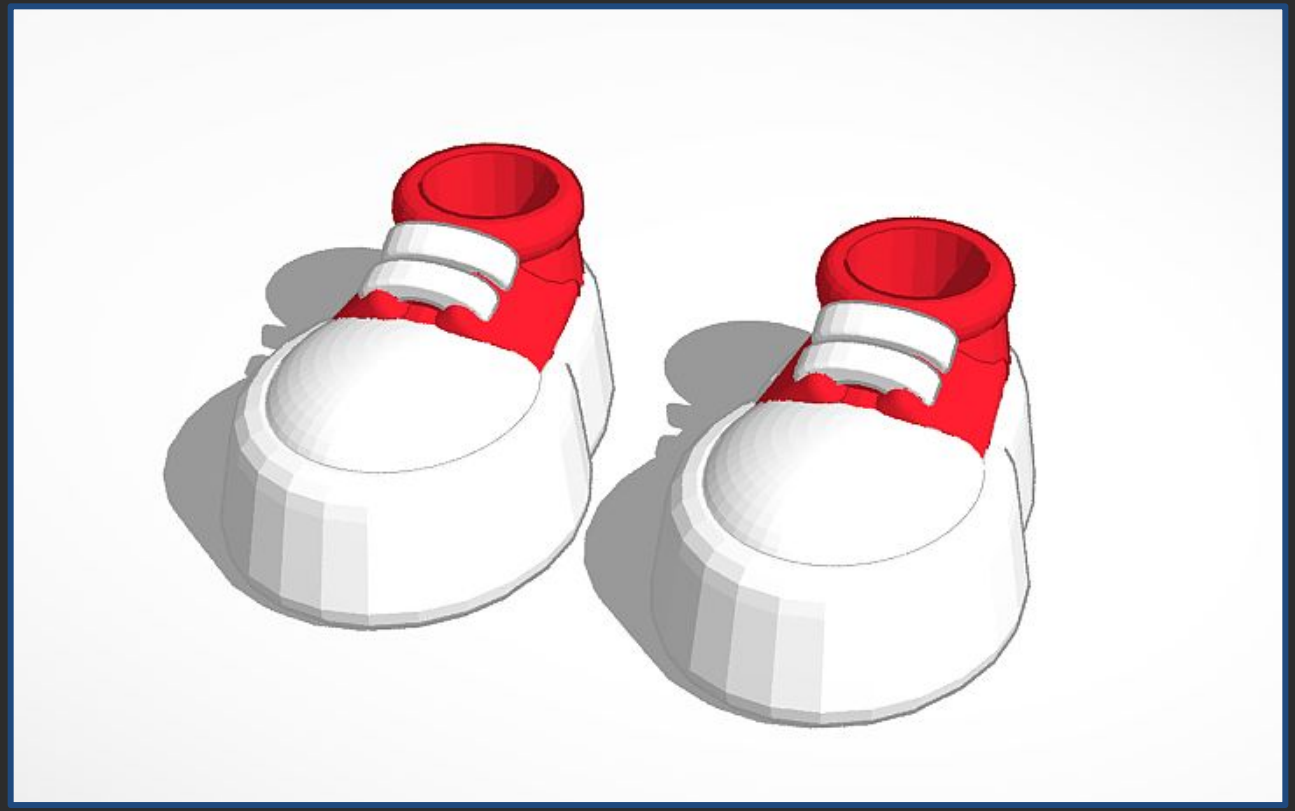
CONSULTANT BRIEF

Overview
A competitive step contest successfully increased student activity levels at Sampleville Middle School.

Recommendation
Implement a permanent 'Step Challenge' program with incentives for top step counts.

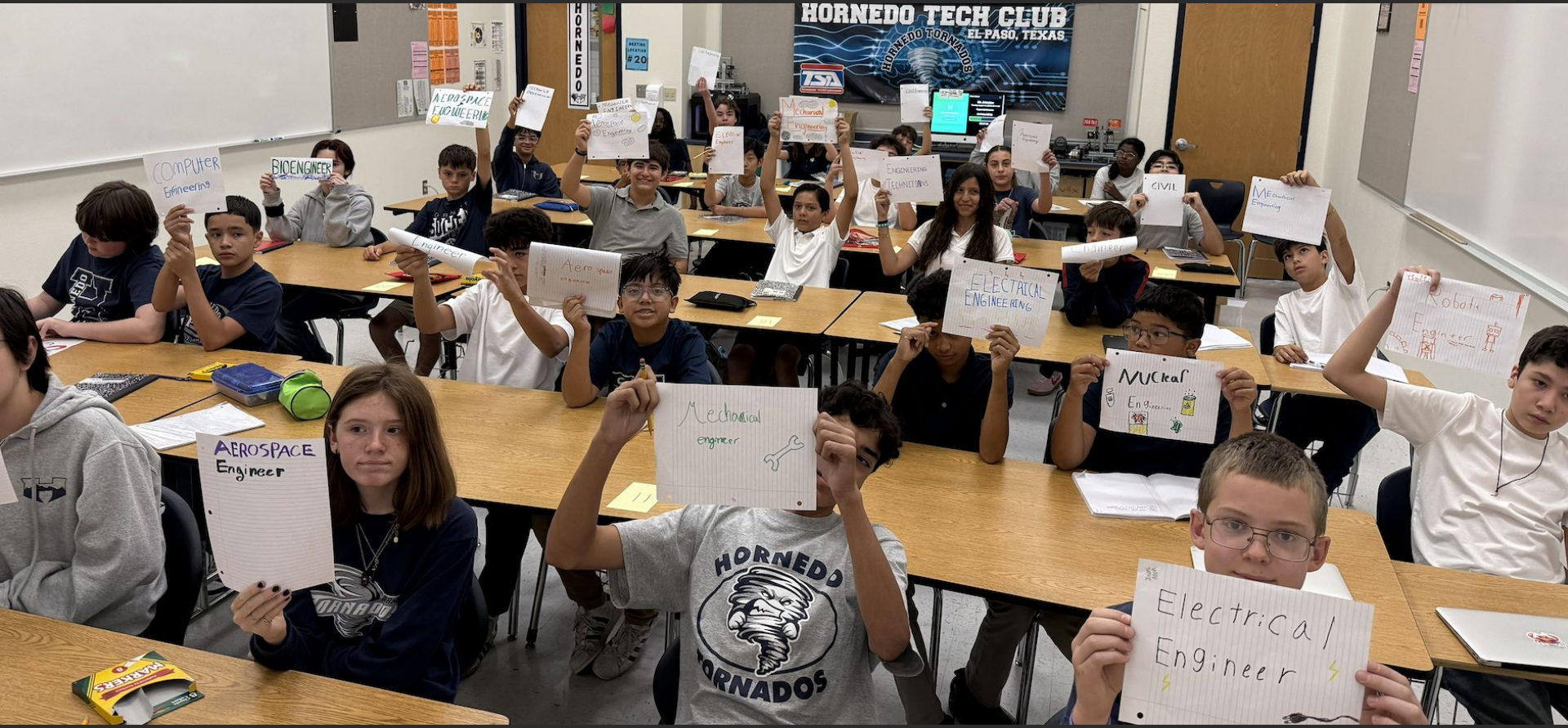
Prototype Concept
Design a shoe with integrated step tracking to

Step 5: Prototype



Step 6: Present

Constructivism in Action



5E Model

Best Practices for MS

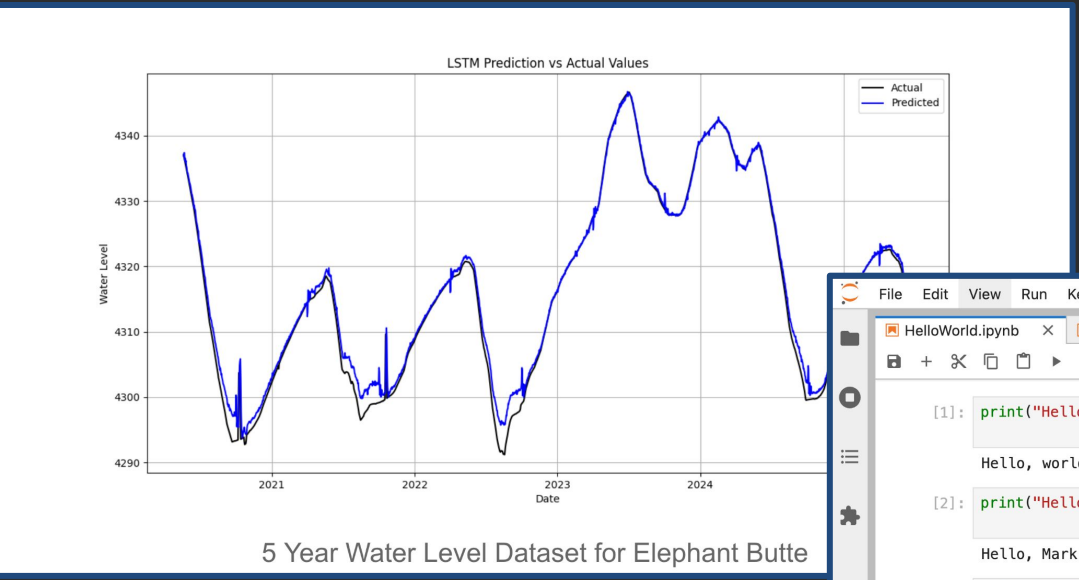
What I Learned

"Water for the Elephant": Water Management in Elephant Butte Dam to allow for Photovoltaic Hydropower Sustainability

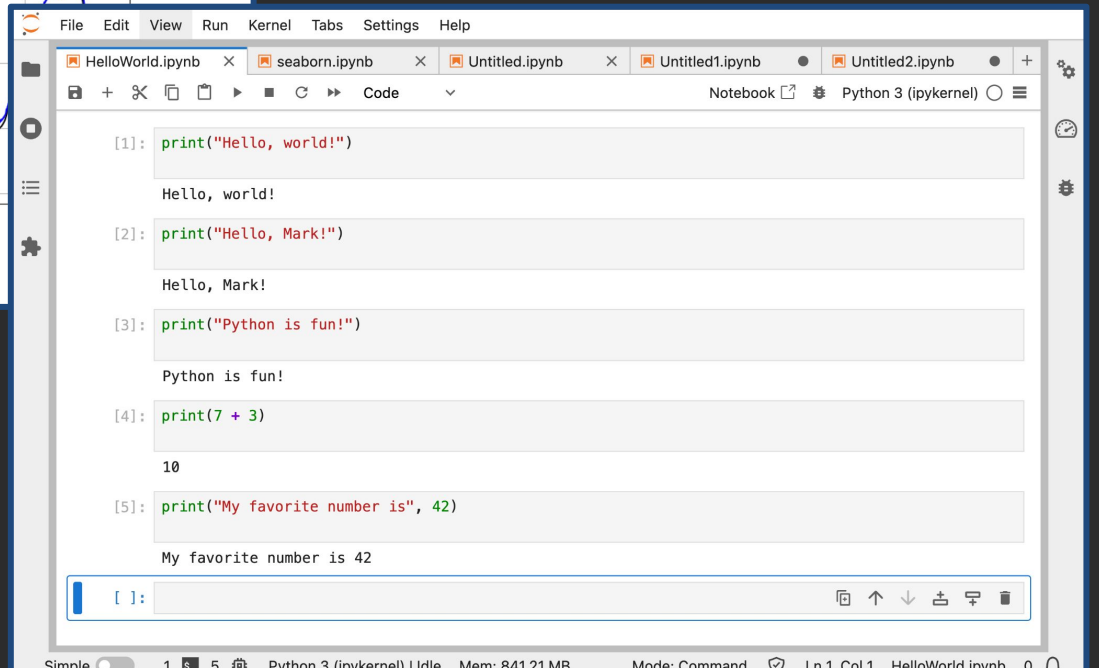
David Alvarado - Center for Career and Technology Education - EPISD
Mark Johnston - Hornedo Middle School - EPISD
Dora Jones - Chapin High School - EPISD
JP Santana - University of Texas at El Paso

2025 CREEDS Summer Institute

How It Transfers

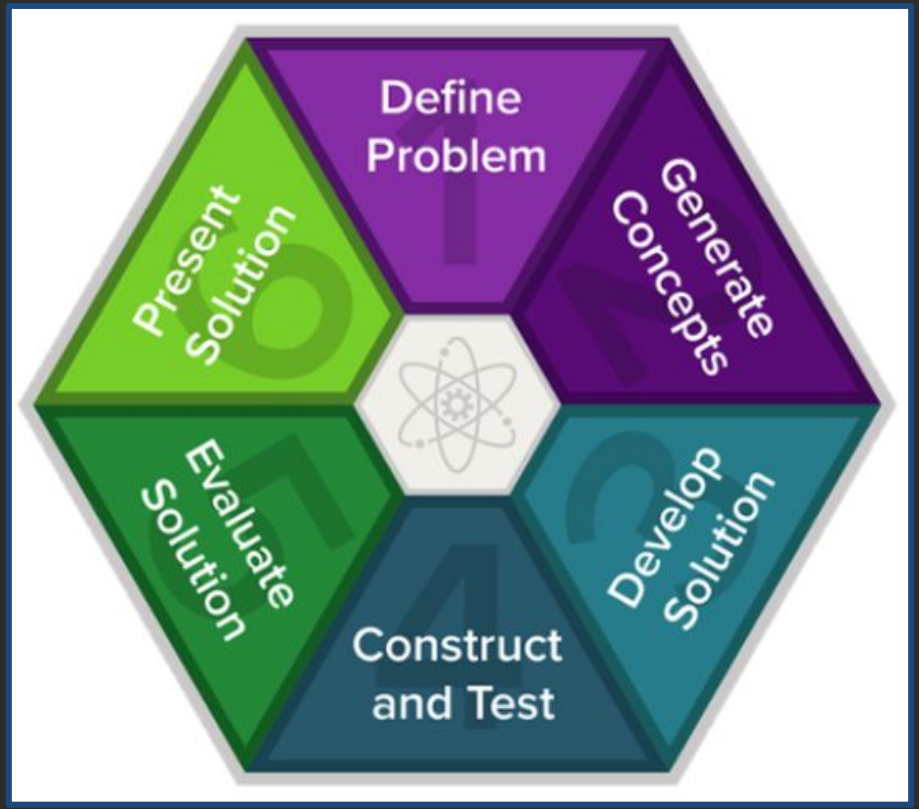


5 Year Water Level Dataset for Elephant Butte

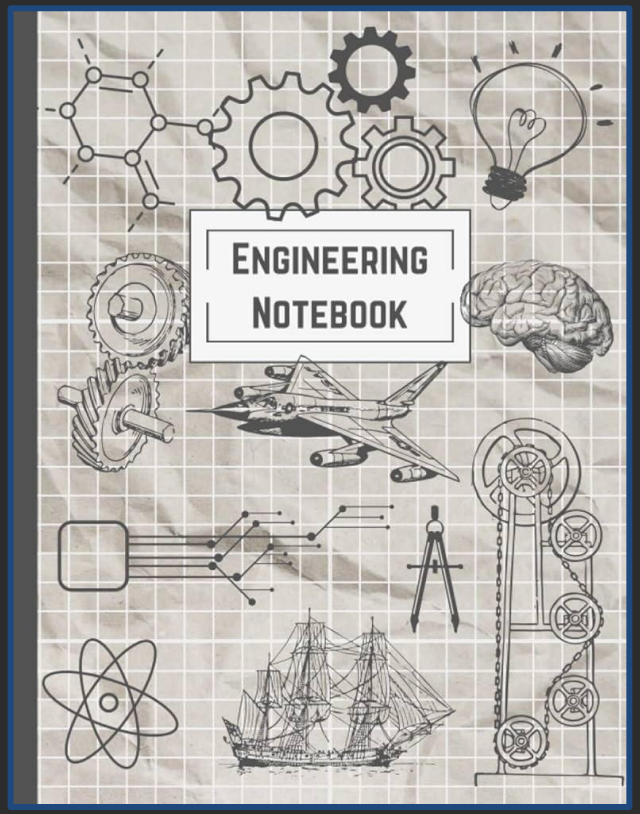


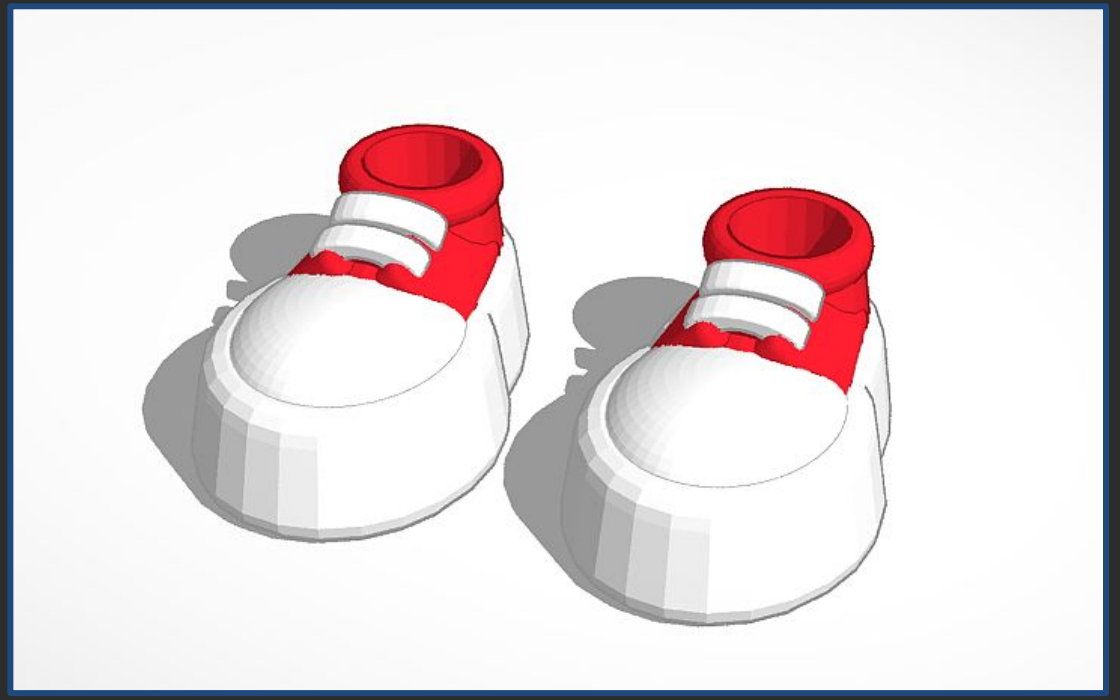
Professional Skills

Engineering Design Process



Documentation & CADD

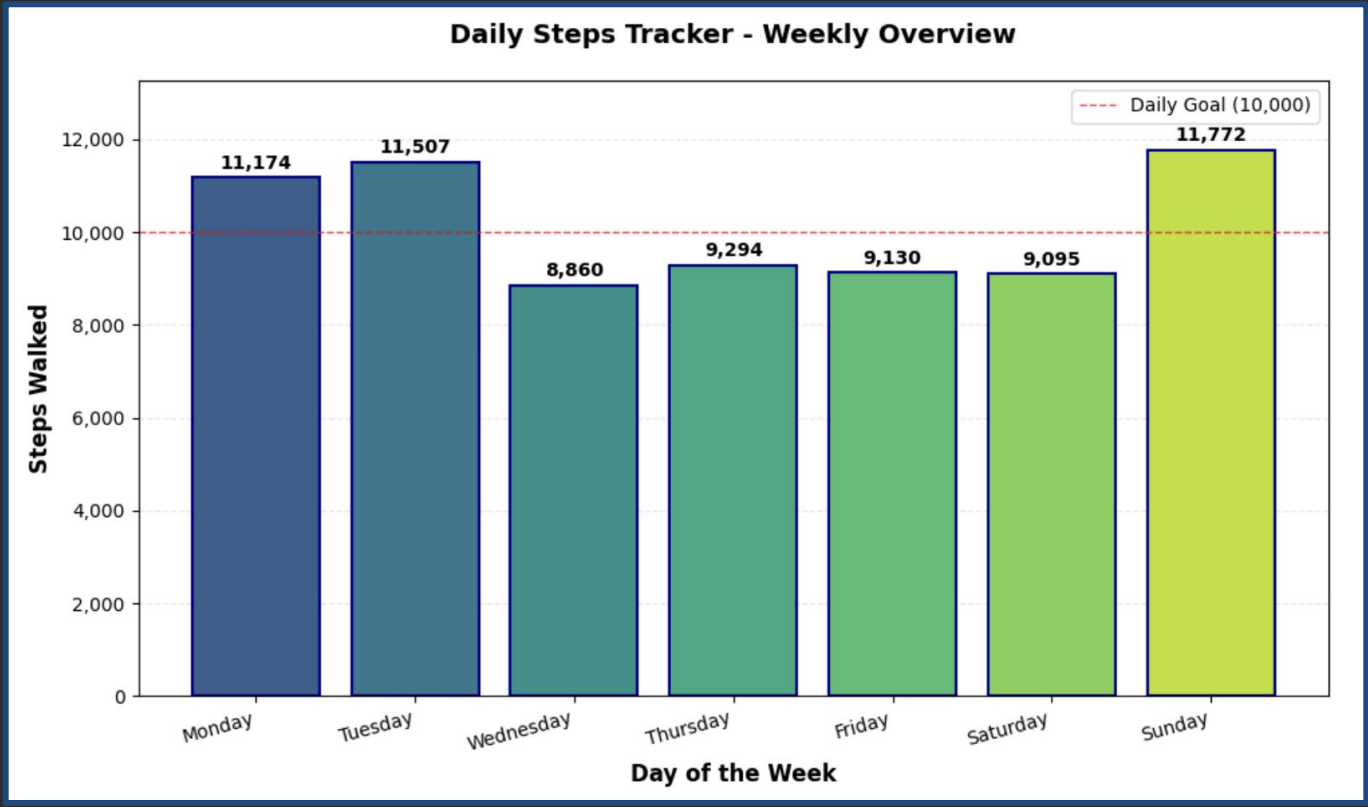




How Would a School Do This?

Students analyze options like pedometers, apps, or team logs, and weigh fairness and cost.

What Students Learn



TEKS Alignment

Professional Standards / Employability Skills

(B) Cooperate, contribute, and collaborate as a member of a group → teams log steps, analyze data, and co-design their TinkerCAD prototype.

(C) Present written and oral communication → consultant brief + presentation to "the principal."

(D) Time-management skills → daily data logging + project deadlines across pre/during/post competition.

(E) Dependability and responsibility → accurate step logging and team accountability.

Engineering & Technology Systems

(B) Identify the inputs, processes, and outputs associated with technological systems →

Input: student steps (sensors/pedometers)

Process: Python modeling & analysis

Output: predictions, recommendations, prototype design.

(D) Describe how technological systems interact to achieve common goals → pedometer + data system + reward program form a system.

(F) Conduct and present research on emerging and innovative technology → wearable fitness trackers & smart shoes as inspiration.

(G) Demonstrate proficiency in the engineering design process → "understand problem → analyze data → predict → design solution → present."

TEKS Alignment

Communication & Documentation

(A) Use clear and concise written, verbal, and visual communication techniques → writing briefs, graphing data, presenting to peers.

(B) Maintain a design and computation engineering notebook → step logs + Jupyter notebook = engineering record.

(C) Use sketching and CADD to develop and present ideas → crude shoe/insole in TinkerCAD.

(D) Use industry-standard visualization techniques and media → charts in pandas/matplotlib; CAD model screenshots.

(E) Use the engineering documentation process to maintain a portfolio → combine notebook, CAD model, and brief.

Progression of Technology

(A) Describe how technology has affected individuals, societies, cultures, economies, and environments → how wearables & gamified competitions affect student behavior.

(D) Predict possible changes caused by advances of technology → modeling the impact of long-term competitions & “what if schools adopted this.”

Critical Thinking & Design

(A) Identify and describe the fundamental processes needed for a project, including the design process → explicit step in project rubric.

(C) Use problem-solving techniques to develop technological solutions → design a wearable or program intervention.

(D) Use consistent units for all measurements and computations → steps/day, percent increase, scaling to 1600 students.

(E) Assess the risks and benefits of a design solution → fairness, equity, student motivation, possible demotivation.

Electrical & Mechanical Systems

(A) Describe applications of electrical and mechanical systems → pedometers, sensors, and wearable electronics as real-world background (even if not building them).

(C) Identify emerging trends in electrical and mechanical systems → fitness wearables, smart shoes, energy-harvesting insoles.

TEKS Alignment

Team Projects

(A) Apply the design process as a team participant → core of project.

(B) Assume different roles as a team member → data analyst, CAD modeler, writer, presenter.

(C) Maintain an engineering notebook for the project → digital logs + Jupyter notebooks.

(D) Develop and test the model for the project → predictive models in sklearn.

(E) Demonstrate communication skills by preparing and presenting the project → summative brief + presentation.

Drafting

(C) Use line-types in engineering drawings + (D–G) 2D/3D visualization skills → addressed at a beginner level in TinkerCAD.

Student Engagement

Personal
Relevant
Authentic

Final Thoughts

CREEDS → Classroom → Student

Fall 2025 – Principles of Applied Engineering

Week	Focus / Summary
Week 4 (Aug 25–29)	Chapter 3: Engineering Design. Quiz Friday
Week 5 (Sep 2–5)	Chapter 3 continued. Test Friday
Week 6 (Sep 8–12)	Chapter 4: Defining Problems & Brainstorming. Quiz Friday
Week 7 (Sep 15–19)	Chapter 5: Researching Designs. Quiz Friday
Week 8 (Sep 22–26)	Chapter 6: Communicating Solutions. Drawings graded
Week 9 (Sep 29–Oct 3)	Chapter 7: Modeling, Testing, Outputs. Unit Test Friday
Week 10 (Oct 6–10)	Finish Ch. 7, review/test. Launch Step Data Project (teams, pedometers). Project kickoff graded
Week 11 (Oct 20–24)	Ch. 8 (Mechanical) + Project – Baseline collection, pandas basics. Quiz + data check
Week 12 (Oct 27–31)	Ch. 9 (Materials) + Project – Competition begins, early charts. Quiz + reflection
Week 13 (Nov 3–7)	Ch. 10 (Manufacturing) + Project – Competition continues, regression. Quiz + model checkpoint
Week 14 (Nov 10–14)	Ch. 11 (Electrical) + Project – Post-competition data, classification. Quiz + reflection
Week 15 (Nov 17–21)	Catch-up/ethics + Project – Forecasting & briefs drafted. Brief draft due
Week 16 (Nov 24–28)	Thanksgiving Break – no school.
Week 17 (Dec 1–5)	Review Ch. 8–11 + Project – Nike TinkerCAD prototypes begin. Prototype sketches due
Week 18 (Dec 8–12)	Wrap-up + Project – Refine prototypes, practice presentations. Rehearsal graded
Week 19 (Dec 15–19)	Final presentations: School + Nike proposals. Final project due

Thank You