Starjumpers: Trig Explorers in Space

Chirau J. Patel
Indian Hill High School, Advanced Pre-Calculus

RET is funded by the National Science Foundation, grant # EEC-1404766

Unit Overview

Topic: Trigonometry

Standards: Common Core for High School Geometry: Define trigonometric ratios and solve problems involving right triangles

Activity Structure

Title: Starjumpers: Trigonometric Explorers in Space

Guiding Questions:

1) How could trigonometry be applicable in space?
2) What are some variables that could affect the design of straw rockets?
3) How could I make a straw rocket that will land in the target zone?
4) What are important ideas & observations I should keep in mind?
5) What purpose do our group roles play?
6) What drives real-life engineering design?

Objectives:

1) Perform trigonometric calculations to determine where a rocket should land within a target planet zone.
2) Build a straw rocket with preallocated materials through an iterative process.
3) Successfully launch a straw rocket within a target zone distance of 5 to 8 feet.
4) Document design iterations during the activity.
5) Be able to discuss future suggestions based off experience through the activity.

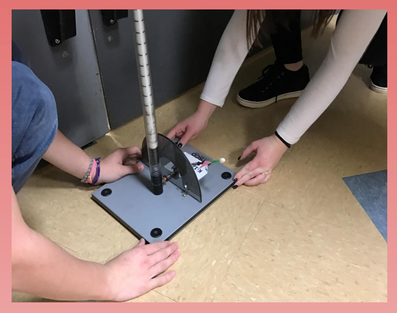
ACS:

Applications: Space vehicle design, trajectory calculations, general engineering practices
Careers: Aerospace engineering, astrophysics
Societal Impact: Better thinkers, creatively minded students, space and engineering aware students

Activity Implementation

The activity was designated for 90 minutes:
- 15 min introduction (Activity and Math clarification)
- 25 min construction/refinement of rocket to reach target zone of 5 to 8 feet
- 15 min calculations for each planetary zone
- 20 min launch for planetary zones
- 10 min conclusion questions
- 05 min activity end discussion

*Pre/Post Assessment conducted outside of the 90 min
*Adjustments included: additional time for trigonometric calculations, extra time for building, and a competition component for furthest distance.



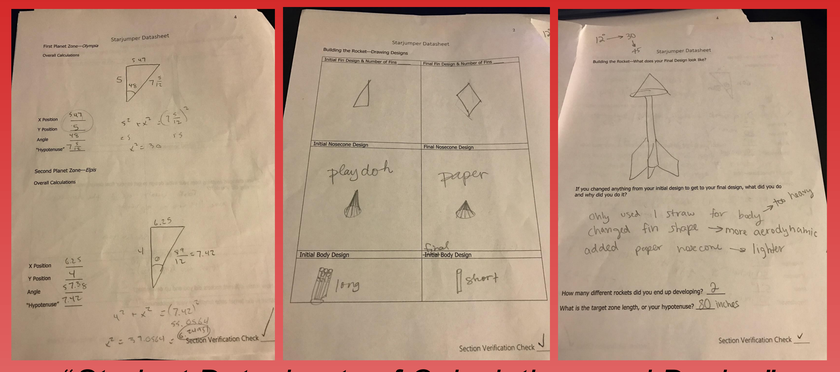
"*Students Launching their Rockets*"

Engineering Design Process

Students had limited materials (5 straws, 8 index cards, etc.) to build their rockets. They built, tested, rebuilt, and so forth within the limited timeframe and materials though an iterative process.

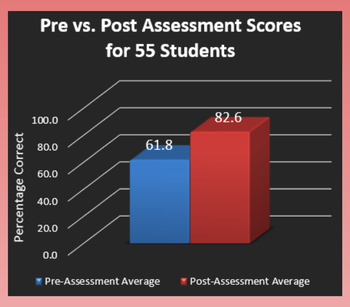
"*Student Straw Rockets*"

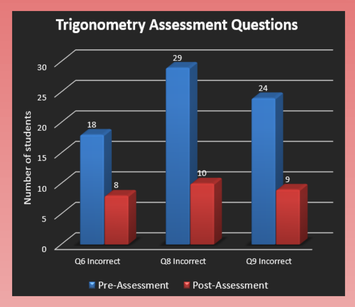
Student Work



"*Student Datasheets of Calculations and Design*"

Assessment Results: Impact on Student Learning





"*Assessment Analysis*"

Reflection and Conclusion

Future Improvements:
- Clear up the trig questions more in-depth
- Eliminate the second planet zone launch because students did not launch for it as often
- Not show a straw rocket model- this allows for the most creative and unseen designs

Successes:
- Every single group was excited and engaged
- They were able to apply and understand trigonometry
- Students launched their rockets with near-perfect accuracy to their planet zone coordinates