

# Rotational Motion Using Augmented Reality: The Asteroids Game

**Philip B Yasskin**, Department of Mathematics, Texas A&M University, [yasskin@tamu.edu](mailto:yasskin@tamu.edu)

**Wei Yan**, Department of Architecture, Texas A&M University, [wyan@tamu.edu](mailto:wyan@tamu.edu)

**Carl Van Huyck**, Independent Contractor, [cvanhuyck@gmail.com](mailto:cvanhuyck@gmail.com)

AIM Special Session on Circles in Motion:  
Energizing Mathematical Thinking in Different Modalities and Localities  
Joint Math Meeting, January 2026, Washington, DC

Pilot Tested at:

TAMU Math Circle – Grades 5-12

TAMU Summer Educational Enrichment in Math – Grades 5-8

TAMU Undergraduate students

Brazos County Youth Career Fair – Grade 8

Houston Science Festival – General Public

Supported by NSG RETTL Grant # 2119549.

## Goals:

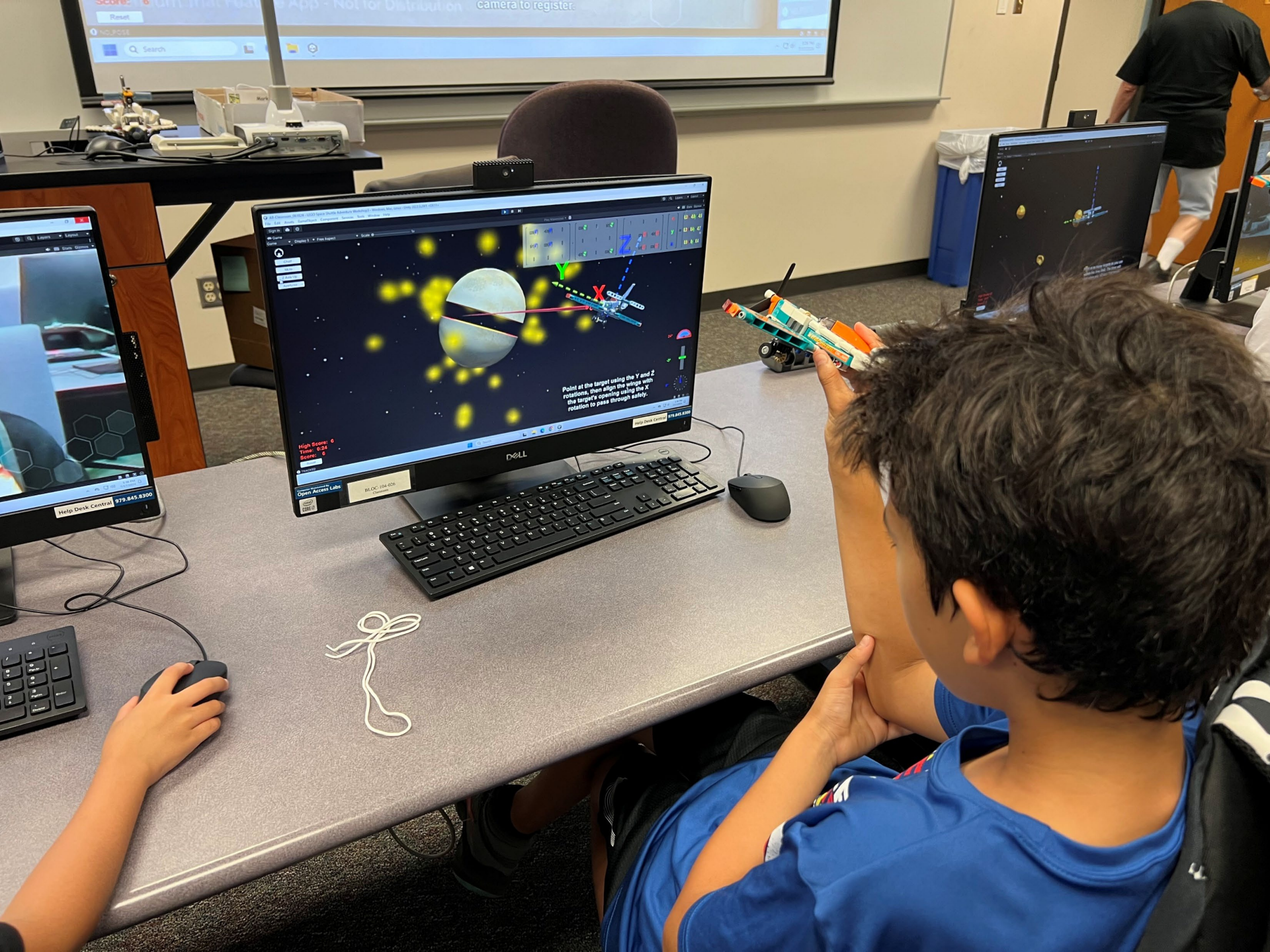
- To use Augmented Reality to help students learn about the mathematics behind rotational motion through haptic and proprioceptive learning.
- To internalize the notions of Yaw (around z-axis), Pitch (around y-axis) and Roll (around x-axis) when describing rotations.

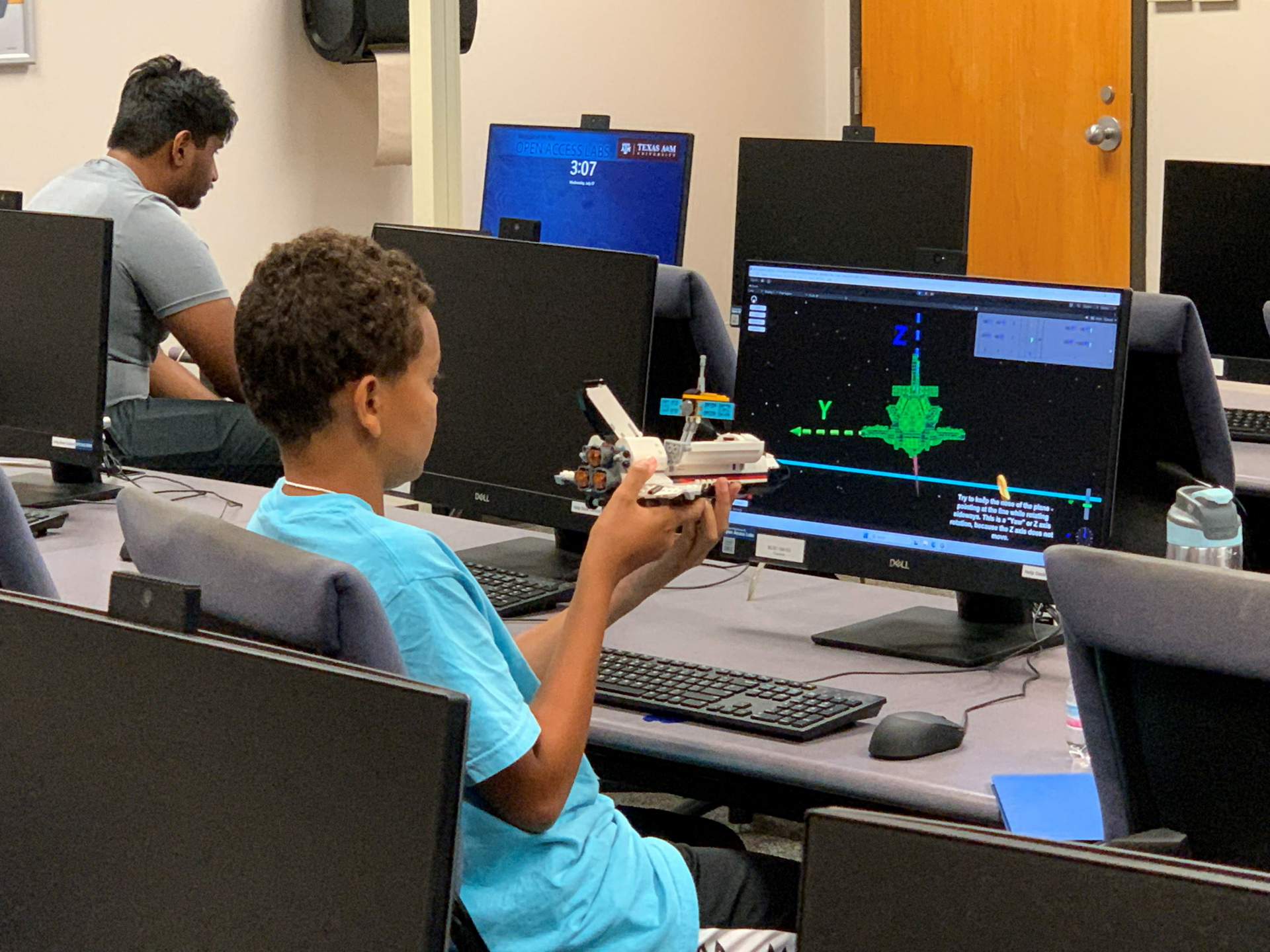
## Method:

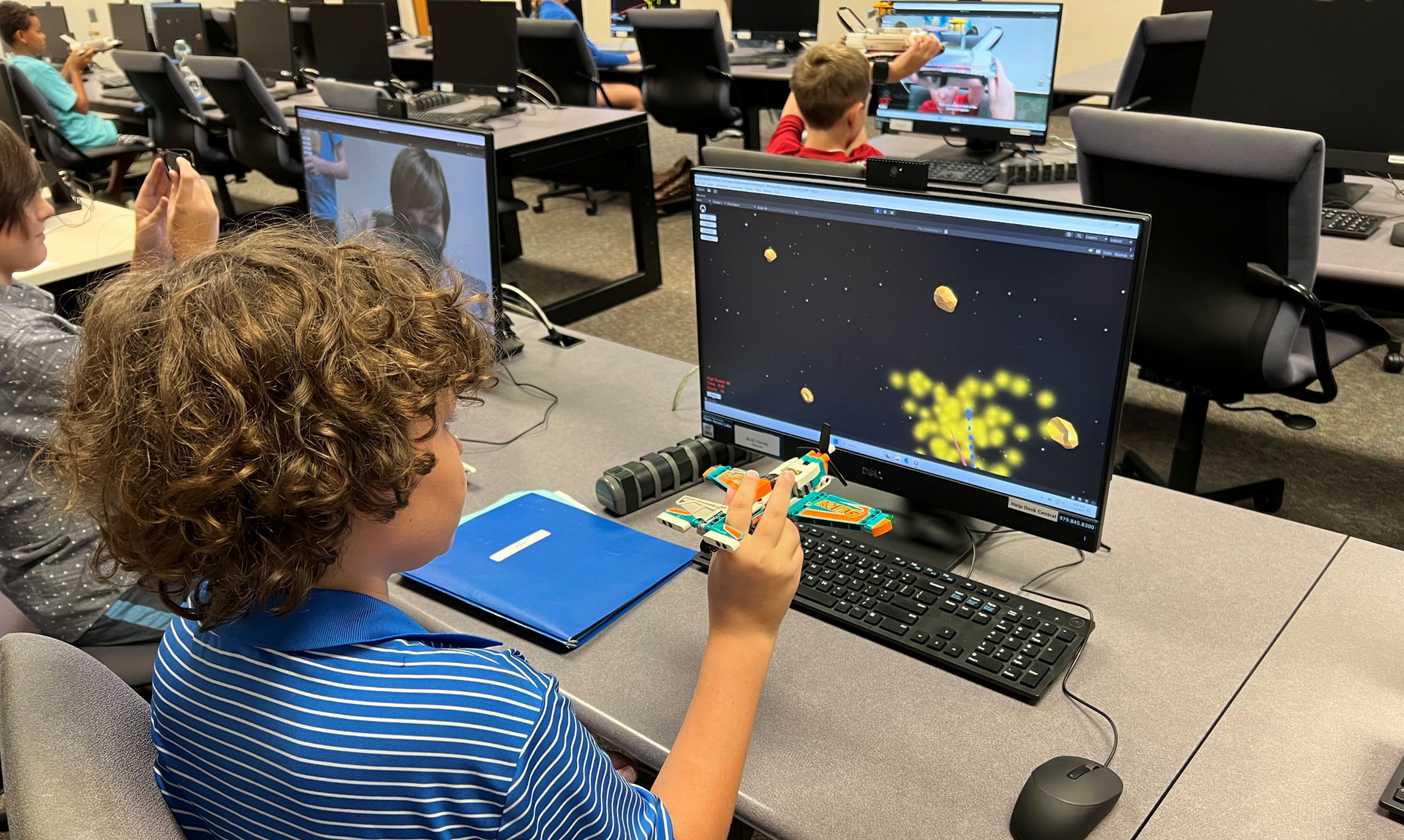
- A student holds a model airplane in front of the computer camera. A virtual image appears on the screen. As the student rotates the airplane, the virtual one rotates and the matrix of the rotation appears on the screen.
- To make the learning more fun, the lesson is presented in the form of an Asteroids Game. On the screen, behind the airplane there are asteroids. When the airplane is properly oriented, the asteroid blows up. Students score for hitting an asteroid. There are successive levels requiring more understanding of the rotations.

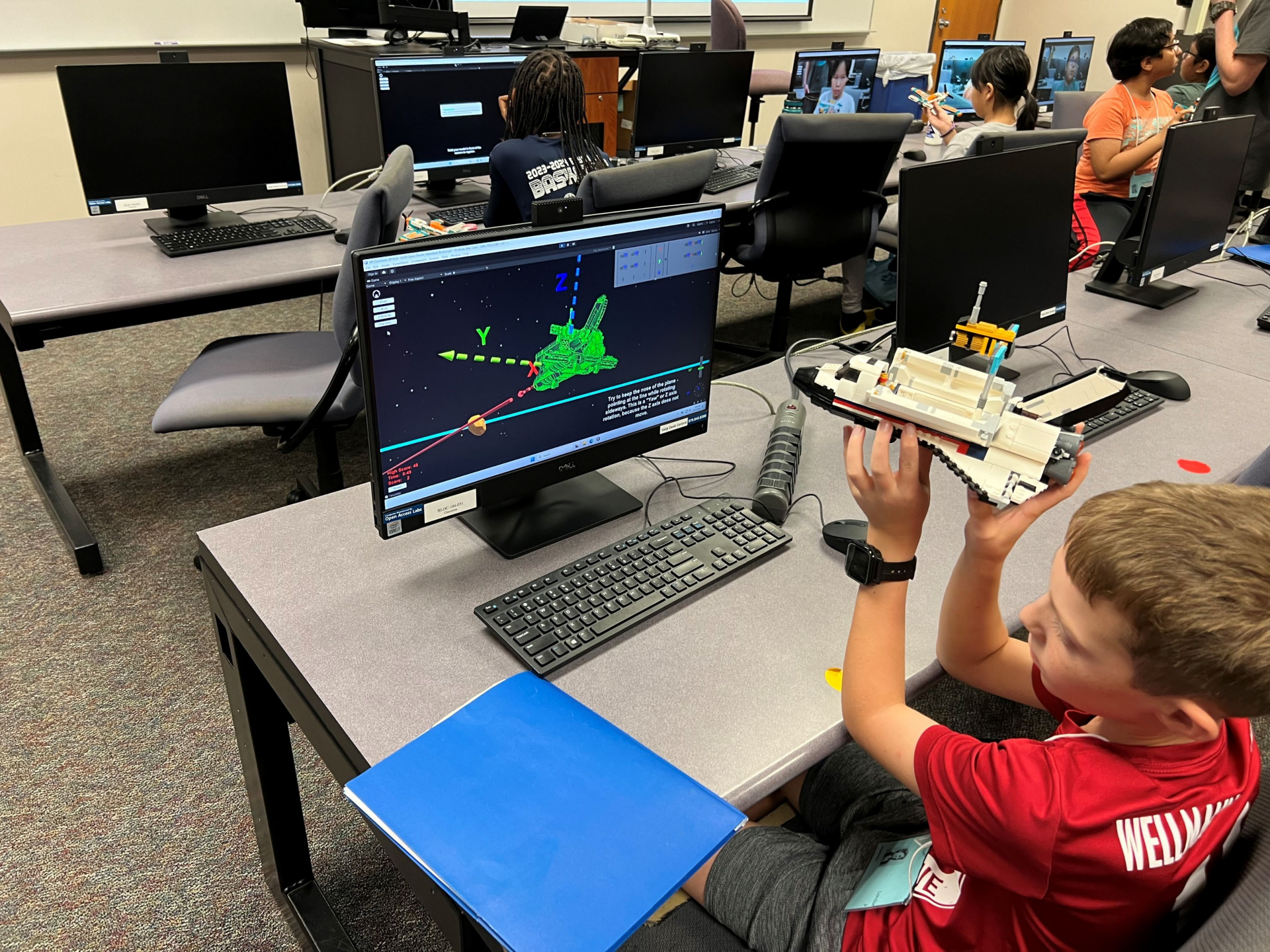
## Levels:

- **Yaw:** Asteroids are on a horizontal line. Students rotate about the z axis which points up.
- **Pitch:** Asteroids are on a vertical line. Students rotate about the y axis which is through a wing.
- **Roll:** Asteroids have an equatorial line. Students rotate about the x axis which is through the nose to align the wings with the equatorial line.
- **Combined:** Students match yaw and pitch or yaw, pitch and roll.
- **Duds:** Only 1 of 3 asteroids is real. Students look in the matrices to find the angles of the real target.
- **Hidden:** The asteroid is invisible. Students look in the matrices to find the angles of the target.









PRINT A PDF PUNCH  
Learn how at [url.tamu.edu/printing](http://url.tamu.edu/printing)

