NJIT New Jersey Institute of Technology

Center for Pre-College Programs

INSPIRING YOUNG MINDS FOR COLLEGE ACCESS AND SUCCESS IN

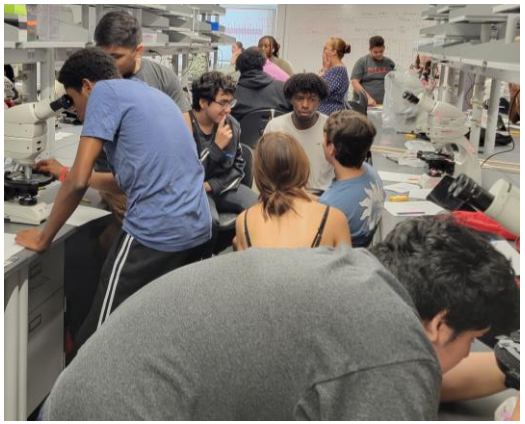
SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM)

AR/VR in Forensic Science: Bringing CSI to the Classroom

NJSTA Convention

October 15, 2024

Agenda for Today



Interactive Extended Reality (IXR) Lab

NJIT Forensic Science Initiative (FSI)

- Began in 2022 with federal COVID recovery $$
- Uses Forensic Science as a *stealth subject* to better prepare students for STEM higher ed
- Focuses on underserved/underrepresented areas
  Student summer, school year, research
- Parallel PD strand
  - HS teachers aligned and enhanced NJIT course syllabus for dual enrollment
  - NJ Forensic Science Education Conference
  - Open to HS bio, chem, physics, FS teachers

HS Student Research

- Spring 2023
- Small groups on established NJIT research projects
  - **AR/VR Crime Scene Scenario**
  - Pain Biomarkers
  - Drone Technology in CSI
  - Mechanical Device Development to Simulate Forensic Evidence
  - NMRI Substance Identification
- Advanced knowledge in each field
- Helped students identify career paths

Forensic Science in the High School Classroom

Newark Forensic Science Curriculum topics (7 units)

1. Introduction to Forensic Science
2. Fingerprints
3. Trace evidence
4. Criminal profiling
5. Ballistics
6. Blood
7. DNA

NJIT Forensic Science Dual Enrollment Course

History of Forensic Science and Professional Practices
Ethics
Crime scene and Death Investigation
Physical evidence
Microscopy, Hair and Fiber evidence
Fingerprints
Bloodstain pattern analysis and Serology
DNA
Drugs and Toxicology
Firearms, ballistics and toolmarks
Document analysis

Why teach Forensics in high school?

As a senior level course, there are many applications of forensic science that encompass the core subjects.

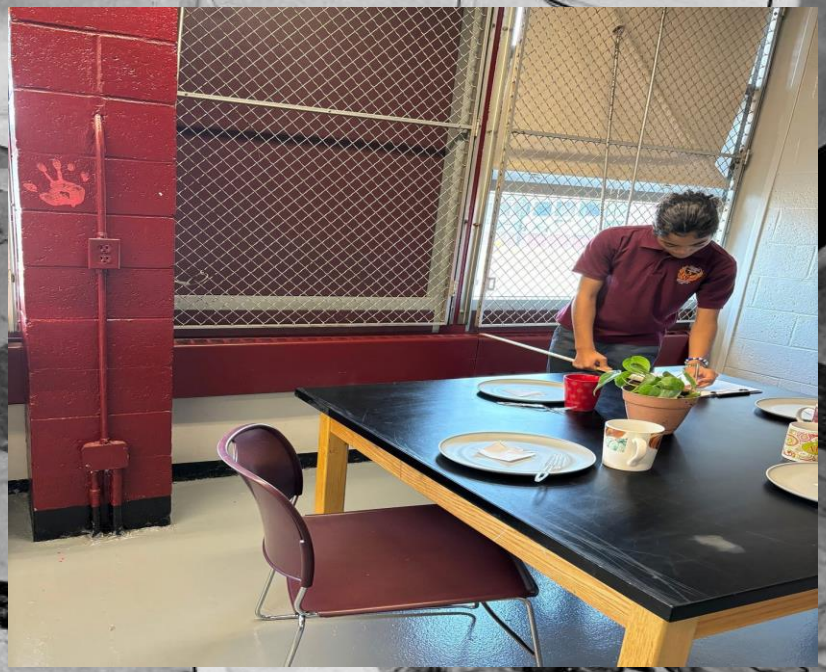
***Ballistics and Blood Spatter - Physics, Geometry, Trigonometry**

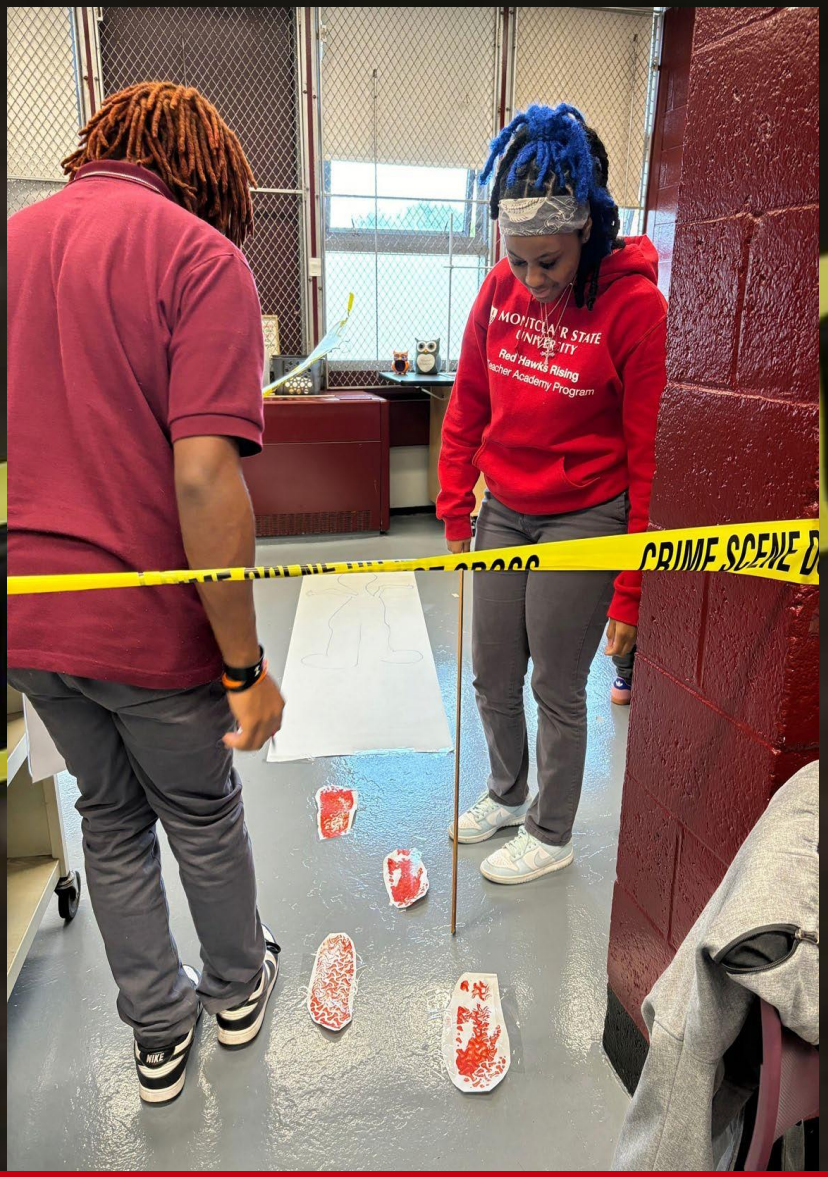
***Blood / DNA - Biology**

***Toxicology - Chemistry**

***Law**

Forensic science provides the students with hands-on, project based learning




MONTCLAIR STATE UNIVERSITY
Red Hawks Rising
Teacher Academy Program
CRIME SCENE


3RD DEGREE
PATTERSON

30 degrees

The bullet on this slide hit the sofa at 30 degrees.

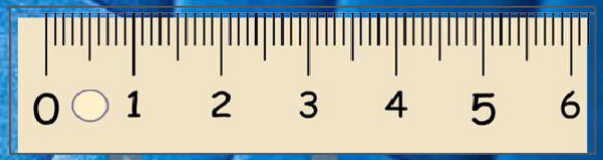
Your goal is to measure the hole and get as close to 30 degrees as you can.

Success is five degrees on either side - between 25 to 35 degrees!

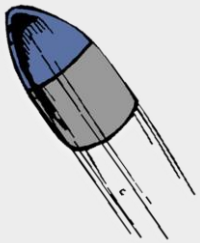
- sin(width/height)

-sin(☐ / ☐)

☐ degrees



Drag and rotate this bullet to show the direction it was coming from when it hit the surface.



Find It!

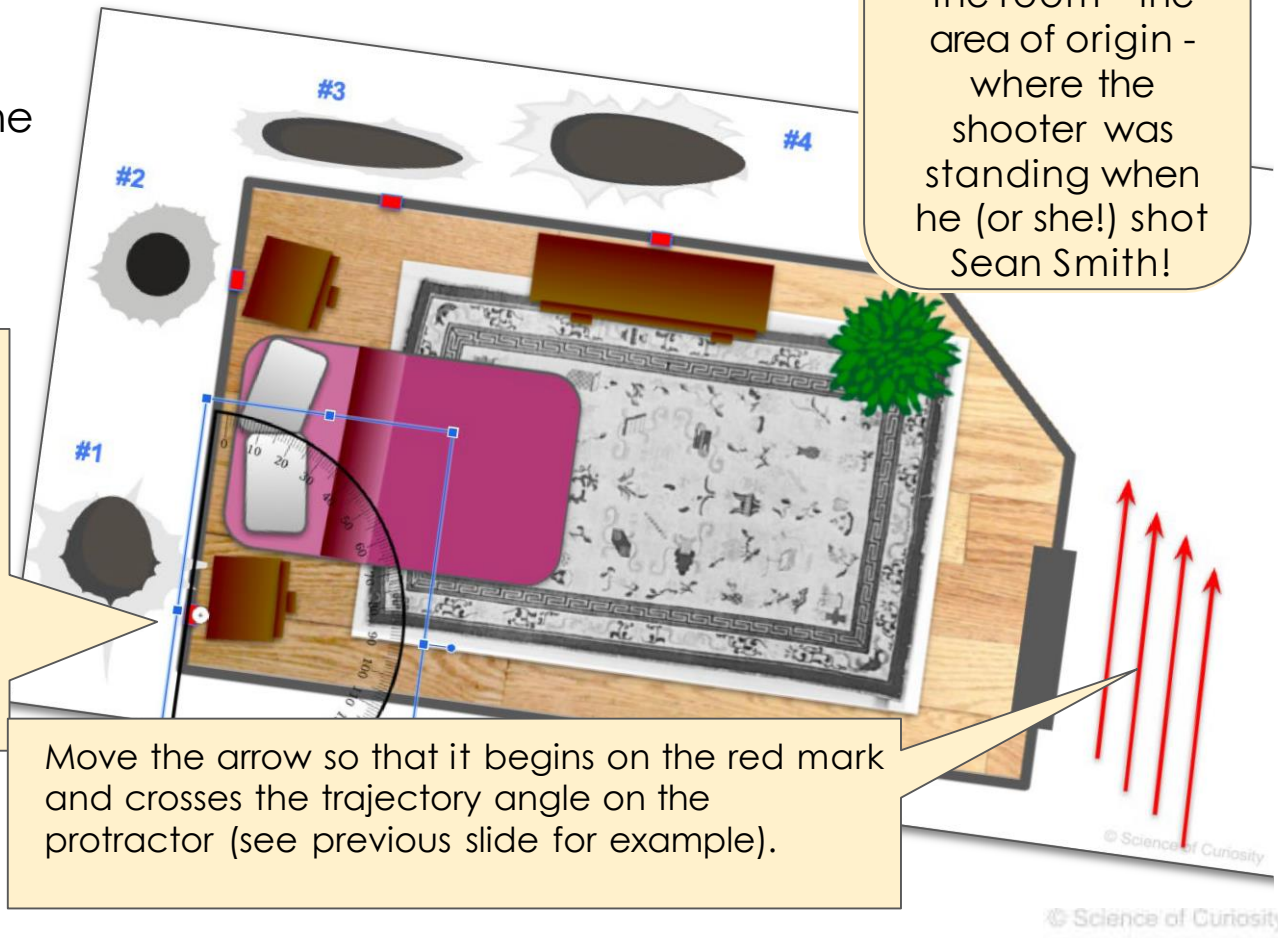
To be successful on the next slide, read this slide carefully!

All lines will converge inside the room - the area of origin - where the shooter was standing when he (or she!) shot Sean Smith!

On the next slide, use the protractor to position each line at the proper angle of impact.

Click and rotate the protractor. Place the protractor's '+' on the red mark where the bullet hole is located on the wall.

Use the trajectory angles you calculated on the previous slides for bullet holes #1-4.



Move the arrow so that it begins on the red mark and crosses the trajectory angle on the protractor (see previous slide for example).

Chemistry and Physics

Most high school physical science classes will feature a mix of direct instruction, self-directed learning, and hands on experience.

- 5E (Engage, Explore, Explain, Elaborate, Evaluate)
  - Modeling
  - Storylines
- POGIL
- Project/Problem Based Learning
- Simulations (PhET, Gizmo, etc) and videos
- Traditional Labs and Problem Solving

Chemistry and Physics – With AR/VR

- Integrates technology in a new way
- Allows students to engage with phenomena that might not be possible otherwise.
  - 3D atomic and molecular models
  - Periodic tables
  - Electron configurations
  - Reactions at the molecular level
  - Kepler's Laws
  - Magnetic and Electric Fields
  - Virtual lab activities

AR/VR in Forensic Science

Experiences as a Student and TA

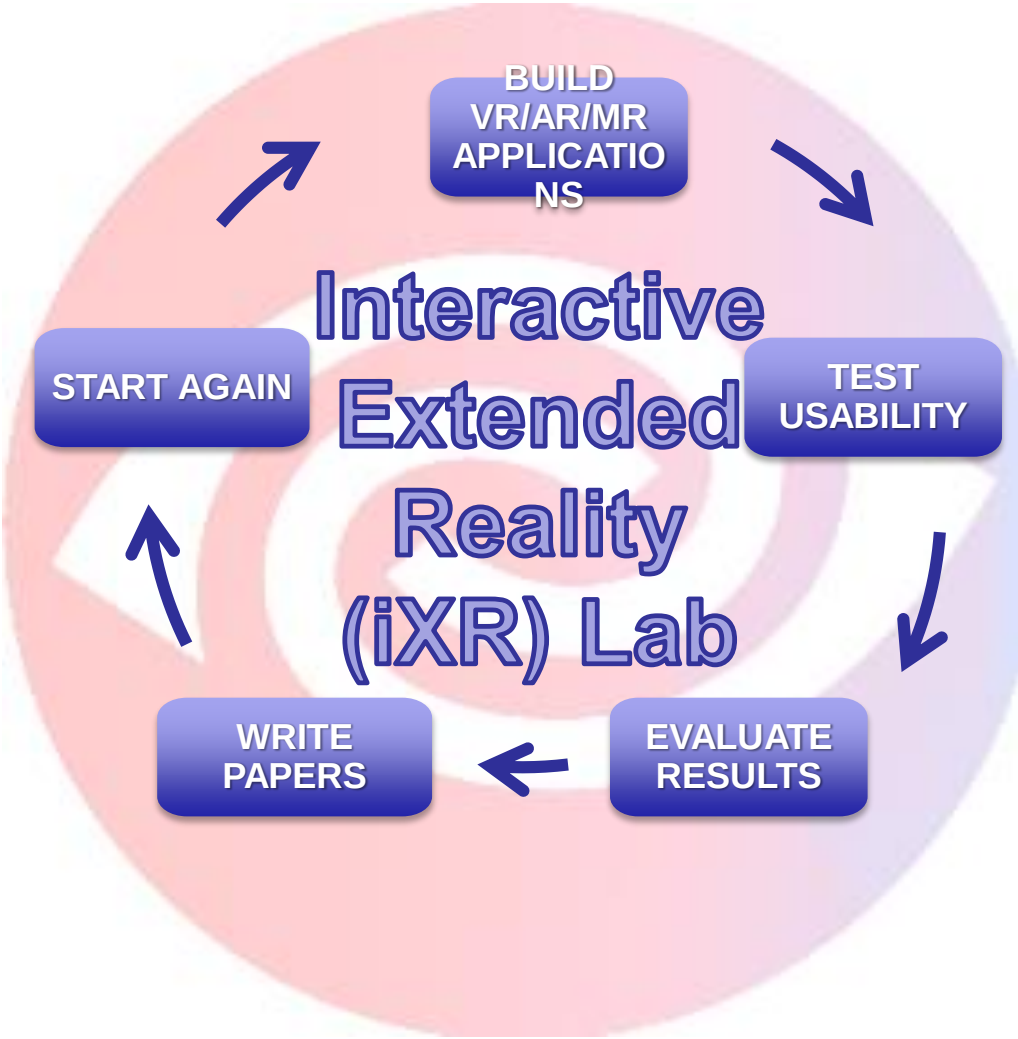
- AR/VR could be used to practice skills and procedures
  - CSI: Crime scene simulations with different scenarios
    - Limited space and resources to create mock crime scenes
    - Practice evidence collection techniques and documentation
  - Forensic biology: Virtual PCR testing
    - Limited access to equipment (thermocycler) and reagents
  - Forensic pathology: Virtual autopsies
    - Practice techniques and aids in visualization of internal structures
    - Dissections in high school

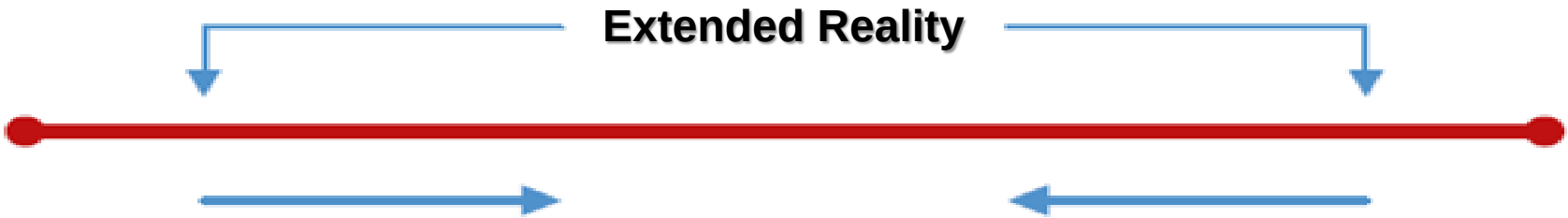
AR/VR in Forensic Science (cont.)

- AR/VR could be useful in addressing weaknesses and misunderstandings
  - Bloodstain pattern analysis: Simulations with better visualization of area of convergence (2D) and point of origin (3D)
    - Stringing technique is tedious and time-consuming
    - Lacks precision and is messy
  - Forensic anthropology: Visualize and reconstruct virtual models of skeletal remains
    - Can study and analyze features that aren't readily visible
    - Assists in trauma analysis

What do we do in the lab?

We *build* and *evaluate* Extended Reality(XR) Simulations and Experiences





Real Environment

Augmented Reality

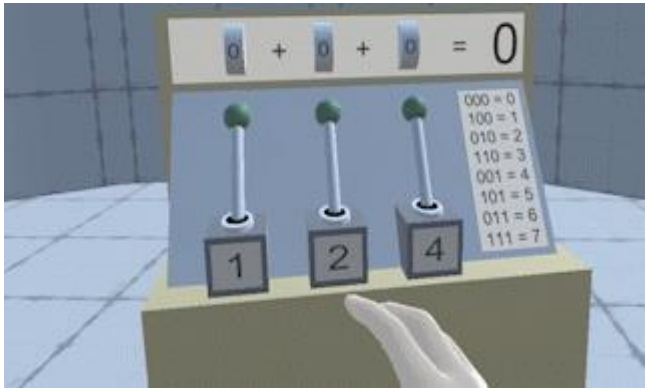
Mixed Reality

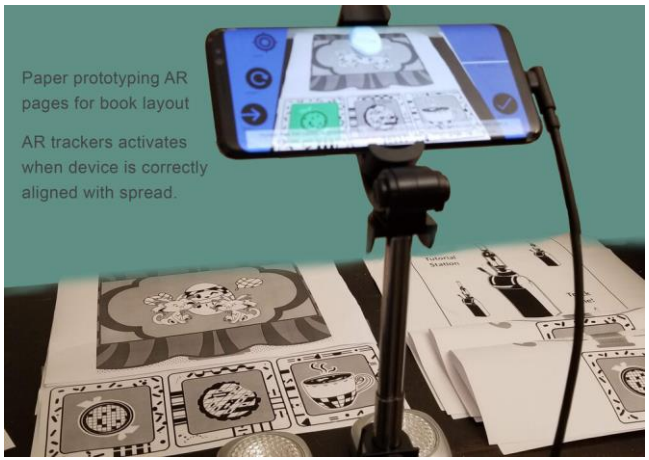
Augmented Virtuality

Virtual Environment

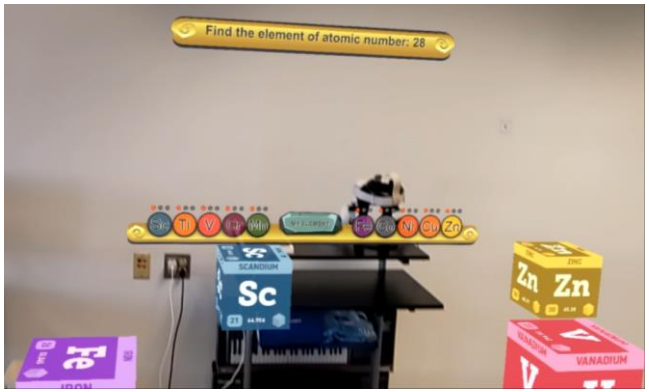
PhD Research

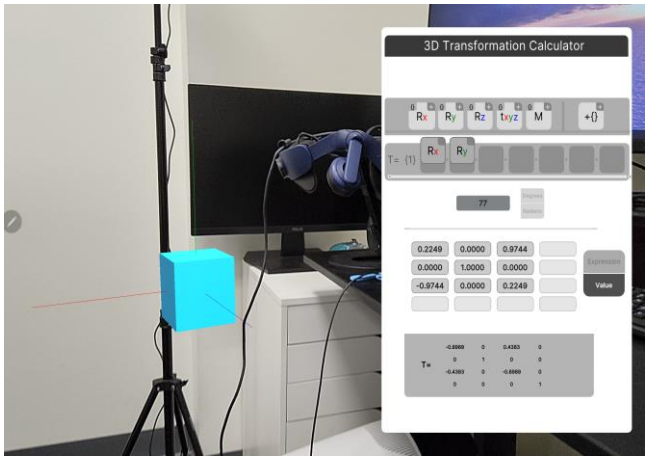
Eric Nersesian



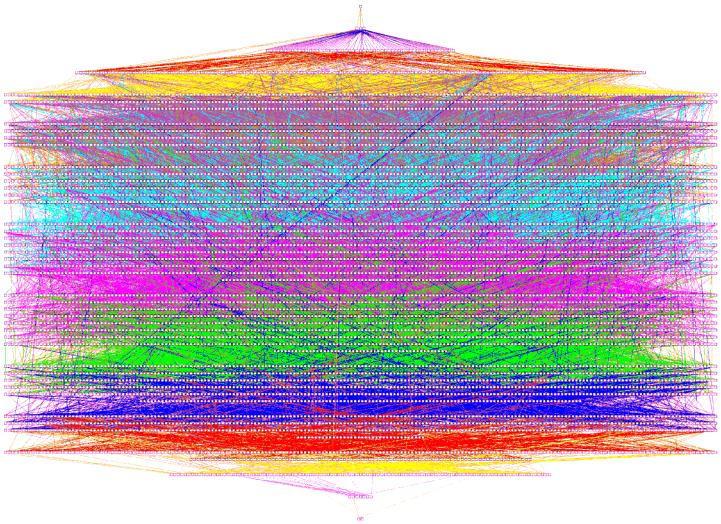


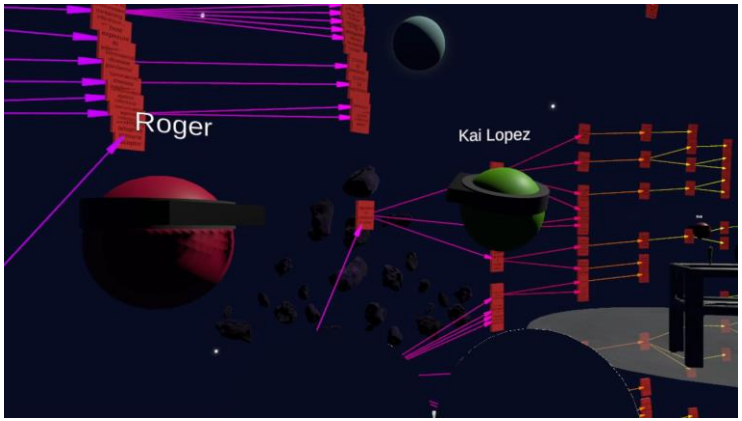
Kantida Nanon

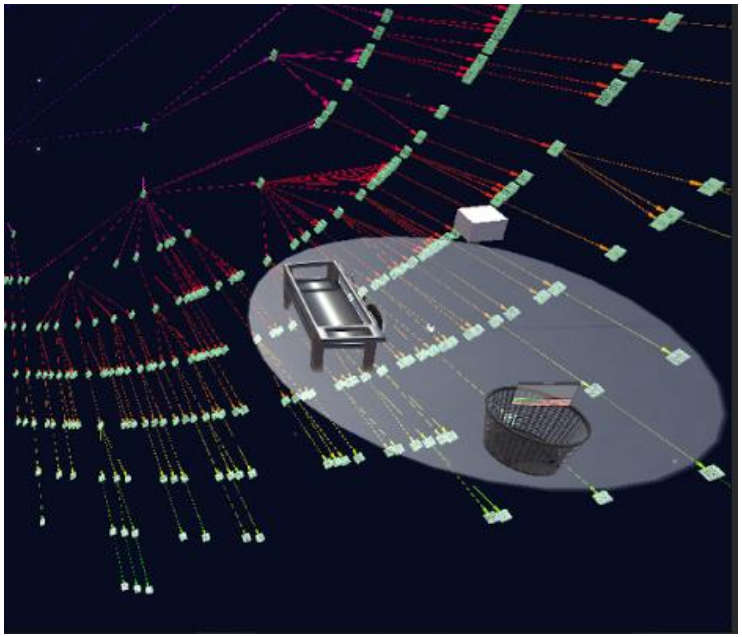




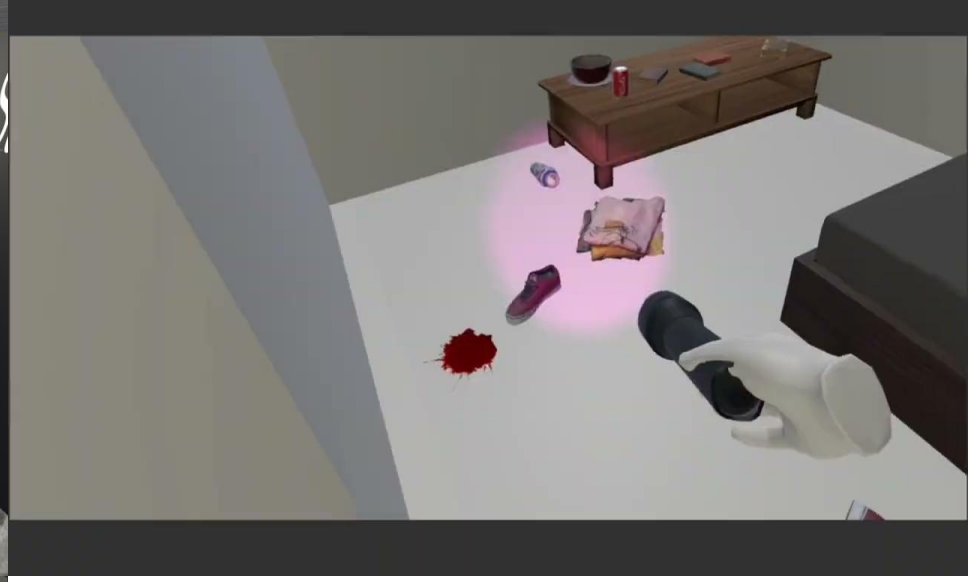
Kian Motahari




Roger
Kai Lopez



Wildlife Education



Forensic VR

Center for Pre-College Programs

Why Extended Reality?

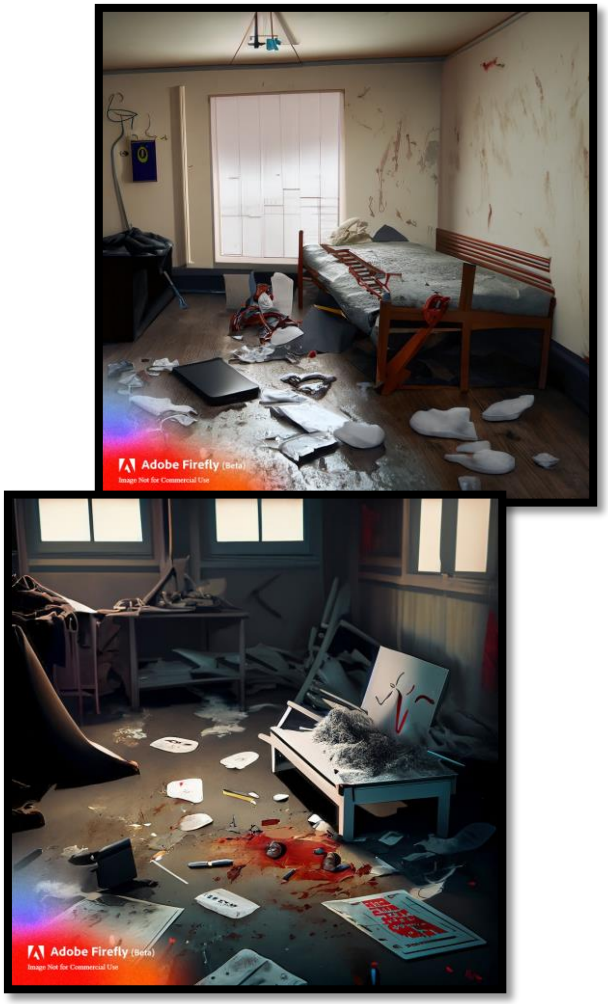
- Practical Benefits
  - Student Engagement
  - Technical Utility
  - Efficiency
  - Safety
  - Variable Control
- Enhanced Learning Experiences
  - Immersive Education
  - Experiential Learning
  - Creativity and Imagination
  - Storytelling & Role-Playing
- Skill Development
  - Motor Skills
  - Cognitive Skills

Dark Side of XR

- Inability to Moderate Experience
  - Lack of Self-Regulation
  - Influence of Uncontrolled Environments
- Desensitization to Violence & Reality
  - Blurred Boundaries
- Physical, Mental Health, and Behavioral Concerns
- Exposure to Inappropriate Content

Forensic VR

- Participation in physical scenarios requires
  - Dedicated space
  - Possible travel
- These scenarios can
  - Be expensive
  - Accommodate only one person per session.
- After each scenario is completed a manual reset of all components within the scenarios is required.



FSI Program – VR Research Project

- During the semester work of the Forensics VR project, a pre-college program was happening simultaneously known as the FSI Program

Outcomes/Objectives

- As a research project, high school students were placed with college students to work on Forensics related projects
- The Mixer Lab took in three of those students for the Forensics VR project
- They were directly responsible with some of the design and testing for our virtual crime scenes where they tested their Immersion.
- They are now ALL NJIT students (Biochemistry, Human Computer Interaction, Computer Science)

For more information

- **Forensic Science Initiative Summer JumpStart**
  - July 7th – August 7th 2025, 9am – 3pm (Mon-Thurs)
  - Registration fee: $60
  - Tuition: $1490 (Some scholarships available)
- **B.S. in Forensic Science *accredited by FEPAC***
  - NJIT's 120-credit B.S. in Forensic Science is New Jersey's ONLY undergraduate forensic science degree program!
- Upcoming programs for students and educators
- AR/VR at NJIT: https://www.njit.edu/emergingtech/extended-reality-xr-lab

Q & A

We want to hear from you:

What questions / comments do you have?

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