# immersiverobotics
## Girls Immersed in Robotics Learning Simulations

**PIs:**
**Florence Sullivan,** *University of Massachusetts, Amherst, Beryl Hoffman, Elms College*

**Personnel:**
**Lissie Fein, Andrew Pasquale,** *Holyoke Codes*

**Research Assistants:**
**Isabel Castellanos, Ali Söken, Özkan Yildiz**

## INTRODUCTION

Project GIRLS' goal is to broaden the participation of middle school Latina girls in computer science and robotics with an immersive narrative of helping people affected by a hurricane.

## BROADER IMPACTS

- Broaden participation of girls and Latinx students in robotics and computer science.
- Build a virtual robotics environment within a hurricane narrative.

## RESEARCH QUESTIONS

**Do immersive experiences improve girls' learning and interest in computer science and robotics?**

**Do all girl vs. mixed gender groups affect girls' learning and interactions in robotics?**

## RESEARCH METHODS

The primary purpose of this research study is to examine if and how engagement with an immersive, first responders, natural disaster co-robotics curriculum affects the following:
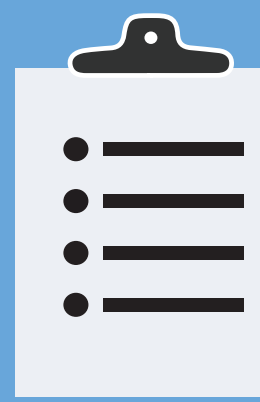
- Girls' interest in the field of computer science
- Girls' feelings about their own ability to succeed in computer science
- Students' ability to program
- Students' knowledge of co-robotics
- Knowledge of the role of emergency managers in hurricane disaster

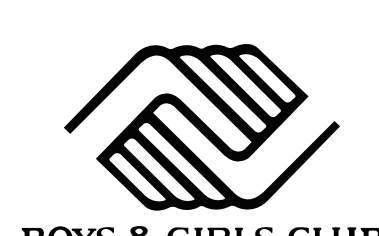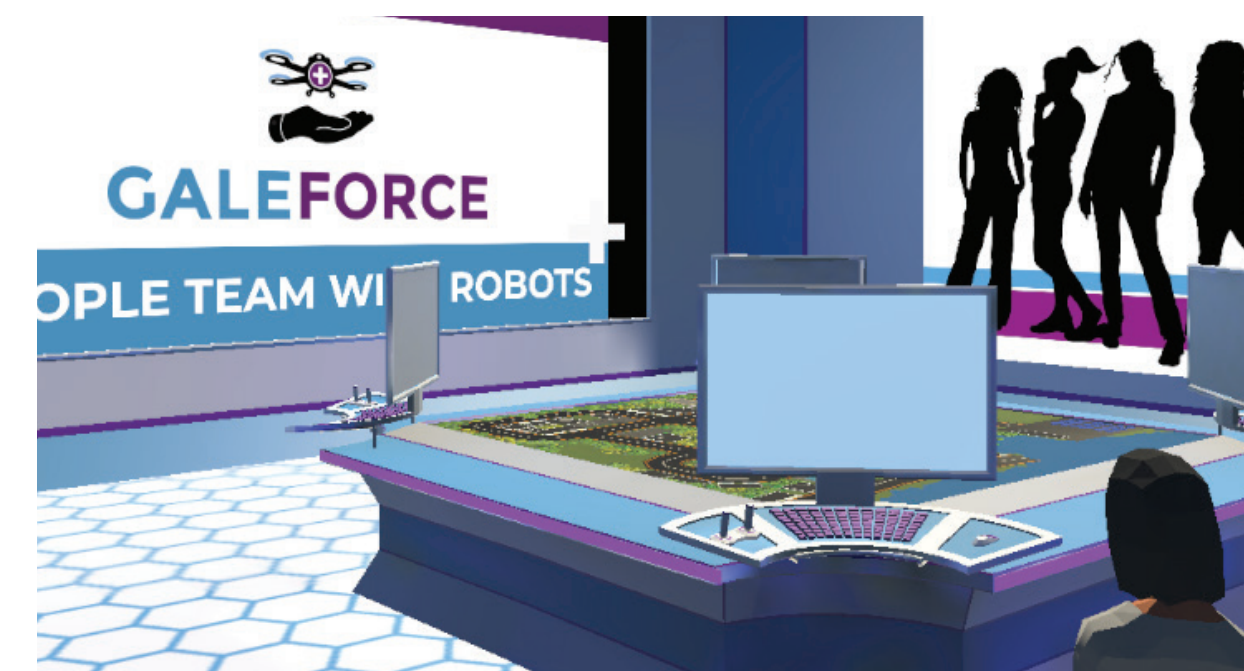| Research Design | We employ a quasi-experimental approach to investigate these questions. Two groups (an all girl group and a mixed-gender group), will engage with the GaleForce game for 15 hours each. |
|---|---|
| Data Collection | • Pre and post surveys about students' interest in and feelings of self-efficacy related to co-robotics<br>• Pre-post content tests related to programming, robotics, and algorithmic reasoning<br>• Observations on how children engage with the GaleForce environment; Using video, audio recordings, and student code<br>• Focus group interviews on children's interest and learning, and their thoughts about the narrative elements of the game |

## PROJECT PARTNERS

UMassAmherst — College of Education

ELMS COLLEGE

girls inc.

BOYS & GIRLS CLUB

Holyoke CODES

MGHPCC — MASSACHUSETTS GREEN HIGH PERFORMANCE COMPUTING CENTER

HOLYOKE

## GALEFOTRCE 3D ROBOTICS ADVENTURE GAME

Students from the Boys and Girls Club in Holyoke, MA code virtual robots and drones, in a narrative of hurricane disaster first responders of the GaleForce in San Juan, Puerto Rico.

### Gameplay

Students train in the control center and then prepare for the next big hurricane and help afterwards working together with the GaleForce team and a fleet of robots and drones.
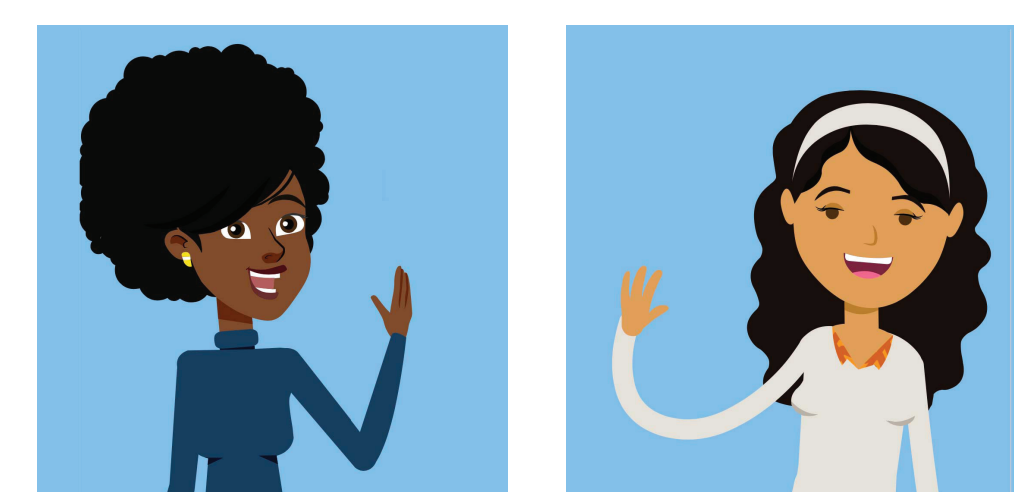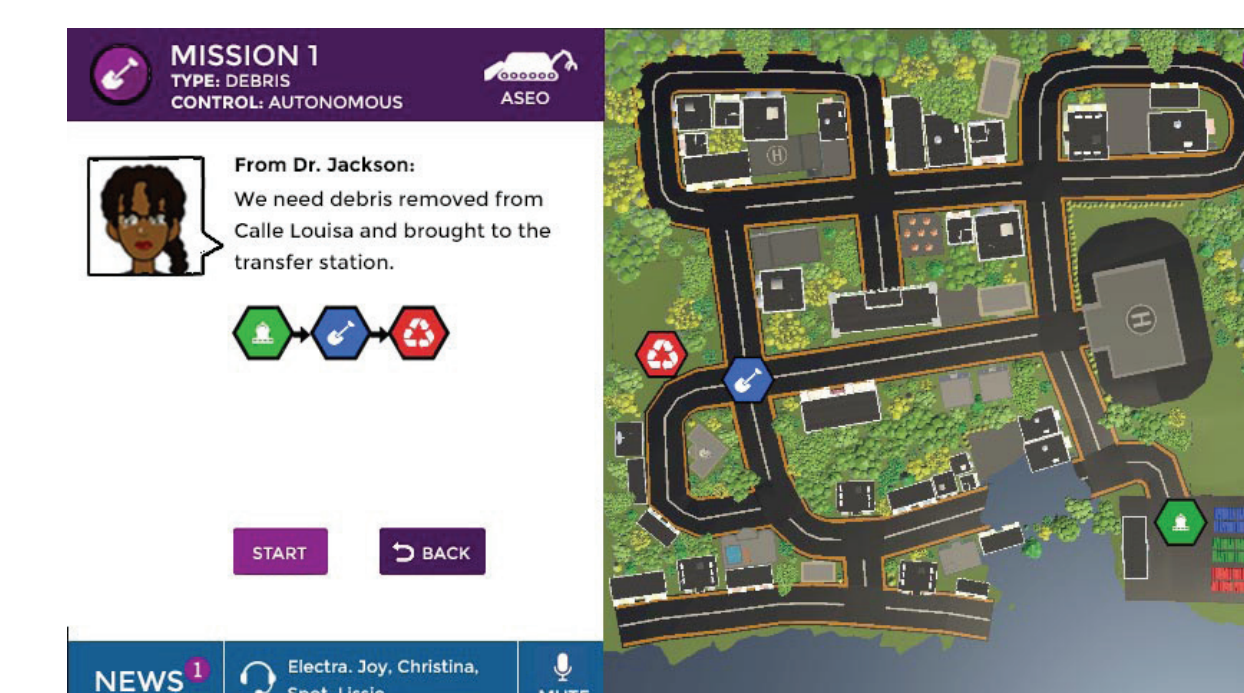
### CONTROL ROBOTS AND DRONES WITH CODE.

### Motivated by Helping

Players complete missions to prepare for the storm and respond after the hurricane hits. The missions involve tasks such as delivering supplies, evacuation, search and rescue of people and pets, and clear roads of debris.

### In-Game Coding Environment

Students learn coding concepts such as conditionals and loops using a block-based programming language as they control virtual robots and drones

### COMPLETE MISSIONS

EVACUATION   MEDICAL   MAPPING   DELIVERY

DEBRIS REMOVAL   DRONE DELIVERY   ANIMAL RESCUE   DRONE CEL SERVICE

### Educational Features
- Narrative to Support Learning
- In-Game Scaffolds
- Collaboration and Pair Programming

### SAMPLE MISSIONS

| Mission | Co-robotics Activity | CS and Robotics Concepts |
|---|---|---|
| **Medical Delivery** | Program robot movement | Sequential coding |
| | Program robots for line following and delivery | Sensors, conditionals, loops |
| | Learn about Machine Learning | Artificial Intelligence |
| **Drone Mapping** | Fly drones with controllers and video feeds | Flight and video concepts |
| | Program drone grid pattern for mapping | Conditionals, loops, mapping concepts |

## PILOT STUDY METHODS

### Mixed Methods Research Study
- Qualitative analysis of student collaborative interactions.
- Descriptive analysis of completed programs.
- Quantitative analysis of pre-post content test.
- Quantitative analysis of self-efficacy/interest survey.

### Participants and Setting
- Eleven 8-9 year old students from the Holyoke Boys and Girls Club (6 girls).
- Five day vacation camp, three contact hours per day.
- Students worked in pairs to solve co-robotics challenges.
- Only 8 students completed content and survey pre-post.

### Data Collection
- Audio of students collaboring while solving missions.
- Completed programs.
- Pre-post robotics content test.
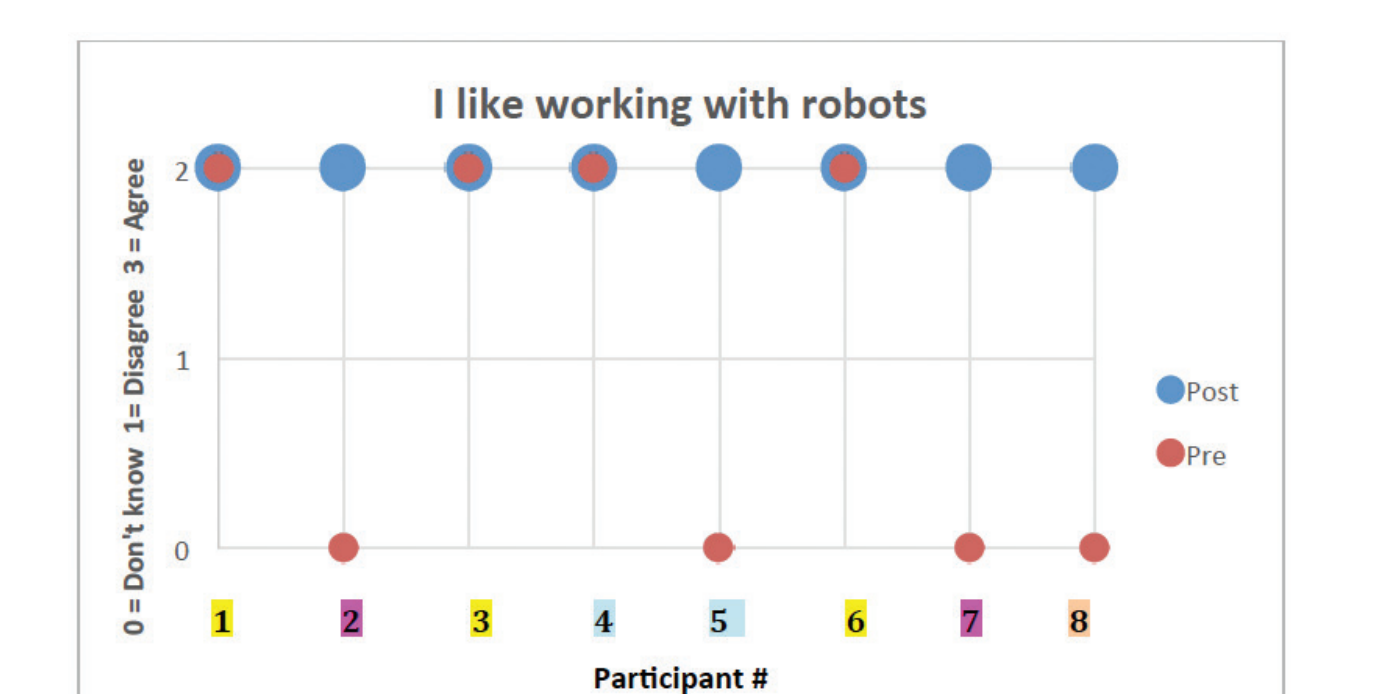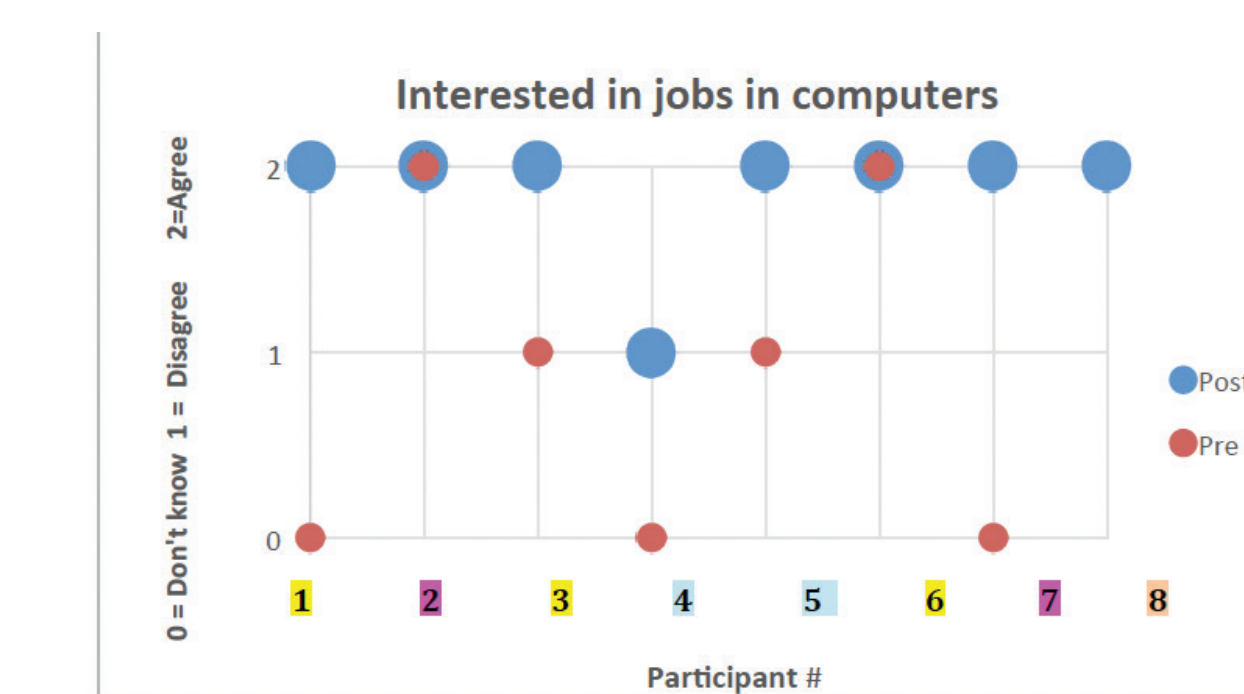- Pre-post self-efficacy/interest survey.

### Data Analysis
- Codebook for analysis of collaborative discussions.
- Gain score pre-post content test.
- Gain score self-efficacy/interest survey.
- Descriptive analysis of completed programs.
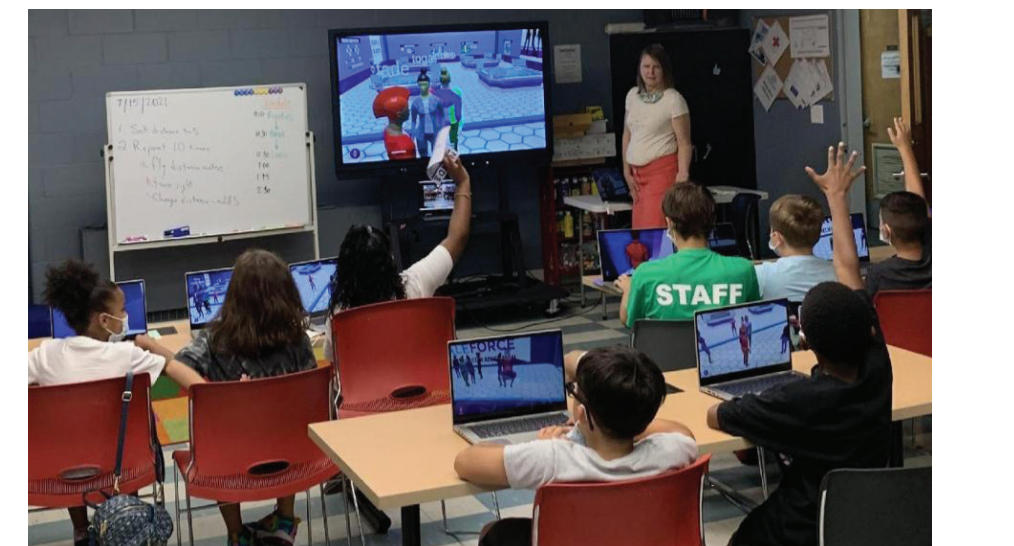
## RESULTS

| | Average Gain Score (as %) Content Test | S.D. (as %) Content Test | Average Gain Score (as %) Interest Survey | S.D. (as %) Interest Survey |
|---|---|---|---|---|
| **Femaies** | 20.00% | 8.43% | 29.75% | 13.79% |
| **Males** | 16.67% | 16.67% | 14.25% | 14.63% |


Interested in jobs in computers


I like working with robots

- Descriptive analysis of coding showed little use of the grid scaffold and sophisticated code blocks, and reliance on concrete referents to reason about writing their programs.
- Collaborative data analysis preliminary results:

  **Over 40% of discussions were about algorithmic operations and variables.**
  - E: Drive forward 80.
  - T: No, we need to follow the curve for 20

  **19% of comments were knowledge reflections. Indicate students aware of solutions.**
  - T: Don't change it.
  - E: Good, we're almost done.