

# immersive robotics

## Girls Immersed in Robotics Learning Simulations

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### 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.

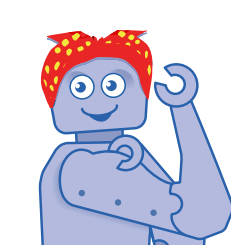
#### Data Collection



- Pre and post surveys about students' interest in and feelings of self-efficacy related to co-robotics
- Pre-post content tests related to programming, robotics, and algorithmic reasoning
- Observations on how children engage with the GaleForce environment; Using video, audio recordings, and student code
- Focus group interviews on children's interest and learning, and their thoughts about the narrative elements of the game

### PROJECT PARTNERS

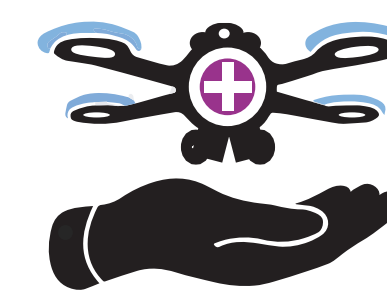
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### 3D ROBOTICS ADVENTURE GAME

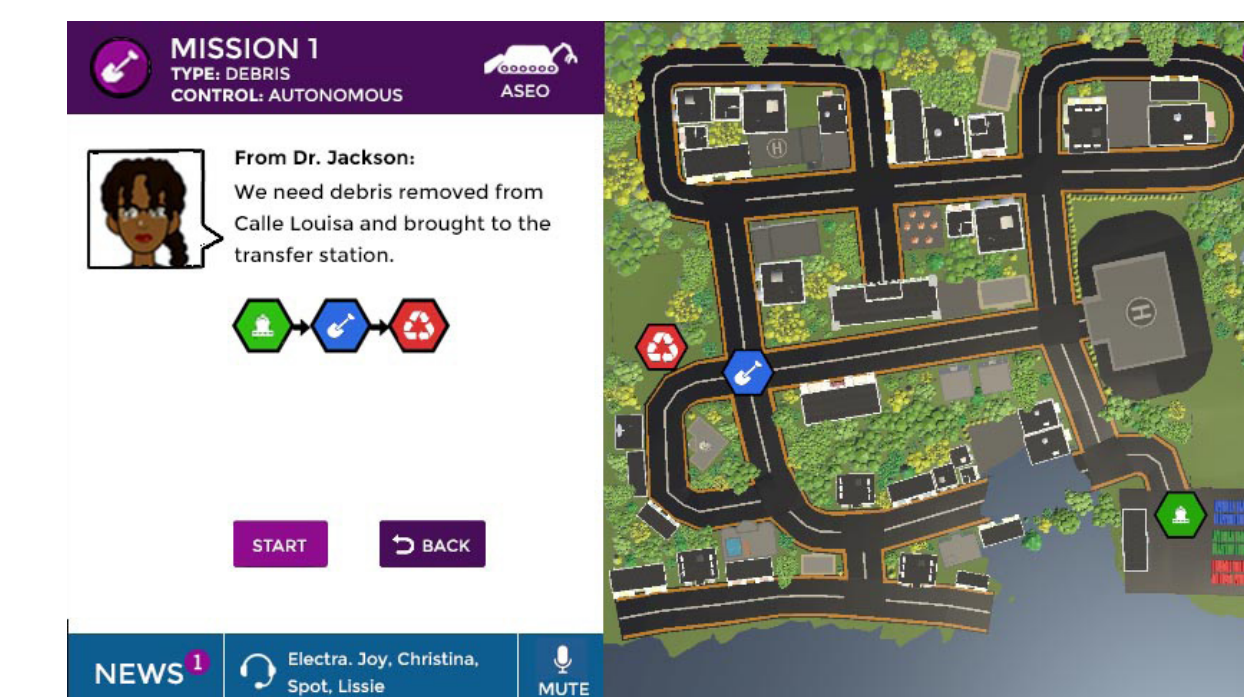


**GALEFORCE**  
ROBOTIC DISASTER RELIEF TEAM

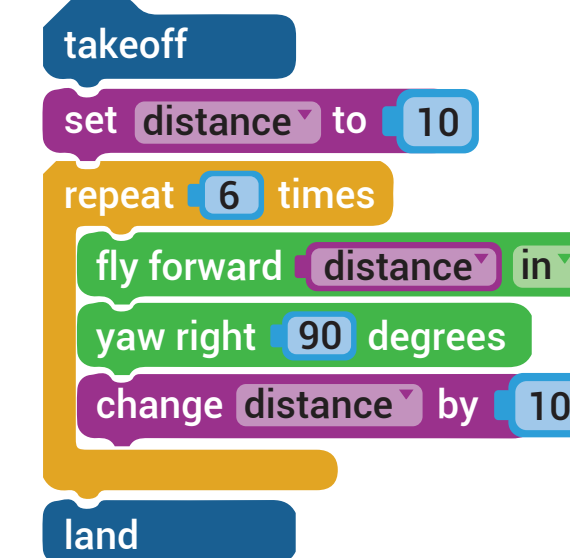
#### Gameplay

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.

Students grades 6-12 from Girls Inc. and the Boys and Girls Club in Holyoke, MA will code virtual robots and drones, in a narrative of hurricane disaster first responders of the GaleForce in San Juan, Puerto Rico.



#### 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



#### 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

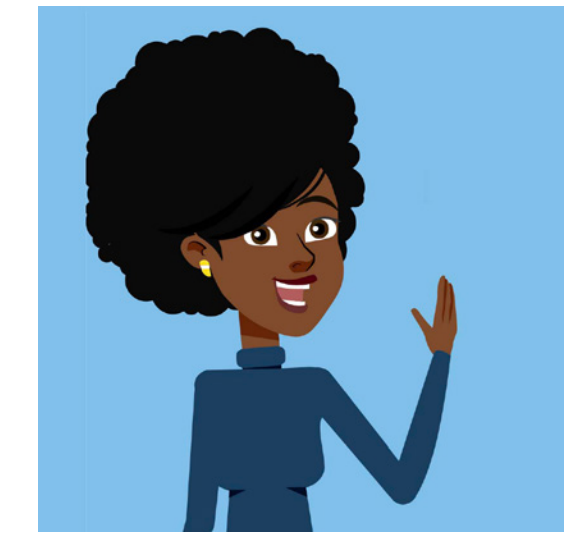
### LEARNING ENVIRONMENT DESIGN ELEMENTS

#### Narrative to Support Learning

Two in-game characters. Dr. Jackson, a female African-American emergency manager and Nalia, a young Latinx girl help students to see themselves in the game as they identify with these characters.

Initially, Dr. Jackson and Nalia present a case story of Hurricane Katrina from 2005 in New Orleans to provide background information on hurricanes and on the field of emergency management.

In the GaleForce game, the same characters continue the narrative and provide background information for training and direction for the game.



**Dr. Jackson**  
Emergency Manager



**Nalia**  
New Orleans Youth

#### In-Game Scaffolds - Tools to Support Learning

- Students play the role of emergency managers with avatars in the control room.
- Infographics in the control room reinforce information about hurricanes and co-robotics.
- Students work in teams and pairs in separate audio channels on hurricane preparation and recovery missions. They control and program virtual robots with multiple viewpoints.
- Storm updates and text alerts by Dr. Jackson and Nalia provide a narrative context for the hurricane and show the complexity of emergency management.

#### Collaboration and Pair Programming

In the GaleForce game, students work collaboratively in teams and pairs to solve real-world problems in a motivating immersive narrative. Pair programming has been shown to increase confidence, engagement, and success (NCWIT).

The benefits of pair programming depends on discrepancy between the levels of expertise and the stage of collaboration (Chong & Hurlbutt, 2007). Students with different levels of ability in the group will scaffold each other as they are working on computational tasks with the quality of interaction. In early adolescents ages 10-13, Hefen et al., (2012) advocate the idea that when partners are on equal social level and are friends, they demonstrate higher levels of reasoning and better quality work. For this group, familiarity and comfort with a partner may result in more learning. Single-sex pairs have higher performance than mixed-sex pairs on some tasks. In this study, students will work with the pair they choose and solve the real life problems in collaboration.

