**SpacEscape – How a Mobile Game Impact Science Learning**

**- 2019 Presidential Research Grant Report**

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## About

This project used a laboratory trial to examine learner problem-solving in a mobile Serious Game (SG) environment designed for learning space science in middle school. It intends to understand if and how mobile game could impact learner problem-solving. To conduct the study, a team of 12 members worked together for six months on the design, development and testing the SpaceEscape mobile game for Android devices. The data was collected in a local middle school, and over 250 students participated in the study. We will share the highlights, findings, and future research in this report.

## Highlights

After receiving the grant, the faculty members assembled the team, and started the game design and development. We will share the highlights on game design and development, collaboration, conference attendance and presentation.

## 1. Game Design and Development

SpacEscape was created at Harrisburg University of Science and Technology (HU) by a team consisting of faculty and students. Specifically, the team includes 2 faculty, 1 graduate student, 4 undergraduate students, and 5 high school students. The game aims to teach solar system concepts to middle school students on a mobile device. See Figure 1 for the game logo.


Figure 1. SpacEscape Logo

The design team met weekly to work on game concept development, asset design and game final mockup. To motivate middle school students to learn space science, the game concept focuses on the solar system. Students will play as a young girl named Lucy and her dog named Spark. In the game, Lucy was trapped on one of the planets in our solar system, and Spark needs to conduct research on the different planets to help Lucy escape.

The game starts with an opening video depicting Lucy playing with Spark in a park. An unknown spaceship passes by and abducts Lucy. The kidnappers leave a walkie-talkie with Spark for communication. After the video, players enter the game start screen. In the game, Lucy sends out 10 clues to Spark in random sequence, which will guide Spark to find her through researching the solar system. See Figure 2 for the assets developed by the student designers.

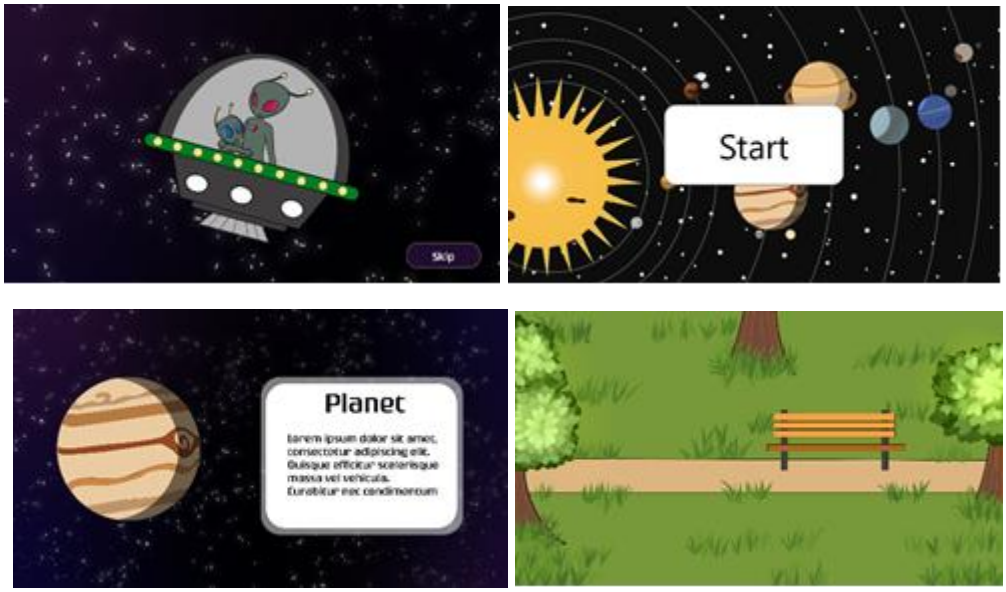


Figure 2. SpacEscape Environment

Based on the design mockup, the development team used the Android SDK toolkit to create the game. We used DigitalOcean cloud product as our server and SQL to construct the database. The Asana team management tool and Github code management tool were also used during the development process.

## 2. Collaboration

In collaboration with Lower Dauphin Middle School, Lower Dauphin High School, American Literacy Corporation, and SciTech High School, the SpaceEscape team created the Android app and conducted testing and research. See the team picture in Figure 3.

Figure 3. First SpaceEscape Team Meeting

269 middle school students from Lower Dauphin school district participated in the study. They filled out the survey, played the game and provided valuable feedback for future improvement. 4 high school students were recruited as project interns in the team. They contributed to the game design, database creation and testing in the process. 1 high school student from SciTech contributed to the graphic design in the team, and she was admitted to HU IMED program for class 2023. 2 IMED students led the game design and graphic design of this project, while the other 2 CICS students led the Android development. Dr. Floyd Stokes from American Literacy Corporation acted as consultant for the team, particularly on the game scripts creation.

Through this collaboration, the team was able to finish the study, and build collaborative relationships with Harrisburg local community.

**3. Conference attendance and presentation**

With the support from the funding. Two faculty led 4 students (3 HU students and 1 high school student) team attended the 2019 Games for Change conference in New York. The team demoed the app to the peer attendees. See Figure 4 for the conference picture.

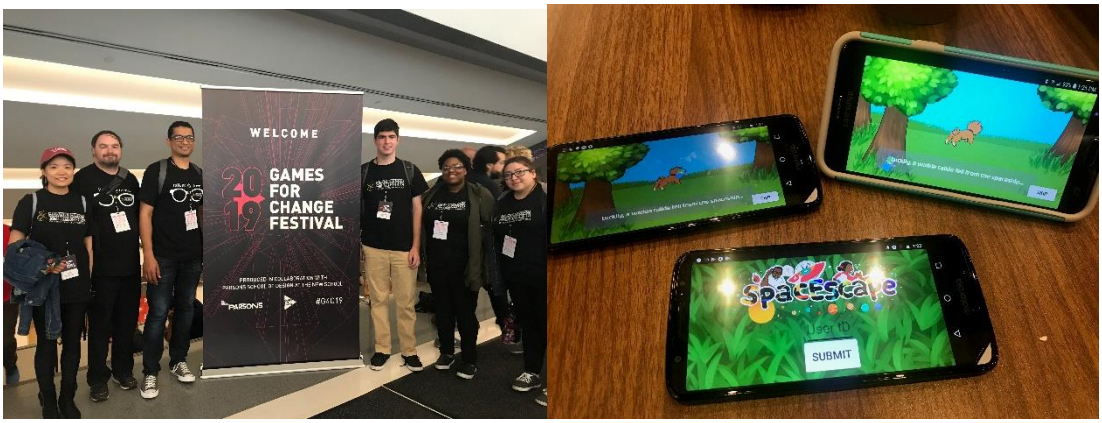


Figure 4. SpaceEscape Team attend Games for Change Conference in New York City.

In addition to attending this conference, the team also submitted a presentation proposal to International Council for Educational Media (ICEM) 2019 conference, which was accepted for presentation.

**Findings**

To understand if and how mobile game could impact learning. We designed pre- and post- science knowledge test and had the middle school students take the test before and after the game play. The game play last for one class period (40 minutes). Among all the student who played the game, 124 students finished the game. Among these 124 students, 70 of them solve the problem in the game, while 54 did not find the solution). In addition, these 124 students played the game for 337 times during one-hour game play (see Figure 5 for the win and lose in the game). There were some students played the game more than 10 times in order to find the

right solution (See Figure 6). We received 269 pre-test responses (M = 43.01), 255 post-test responses (M = 57.25). The test score increased 14 points in average.

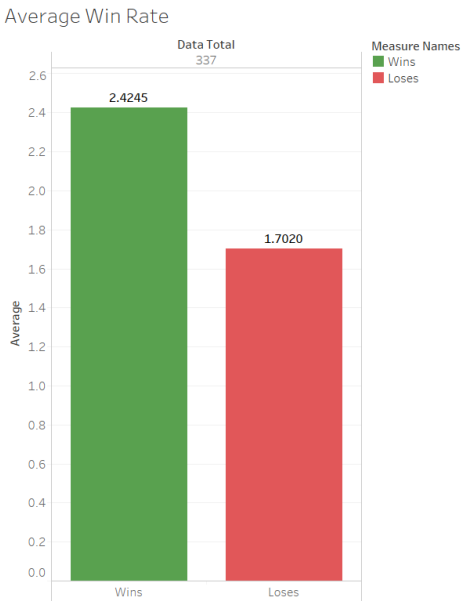


Figure 5. Game Play Wins and Loses Times

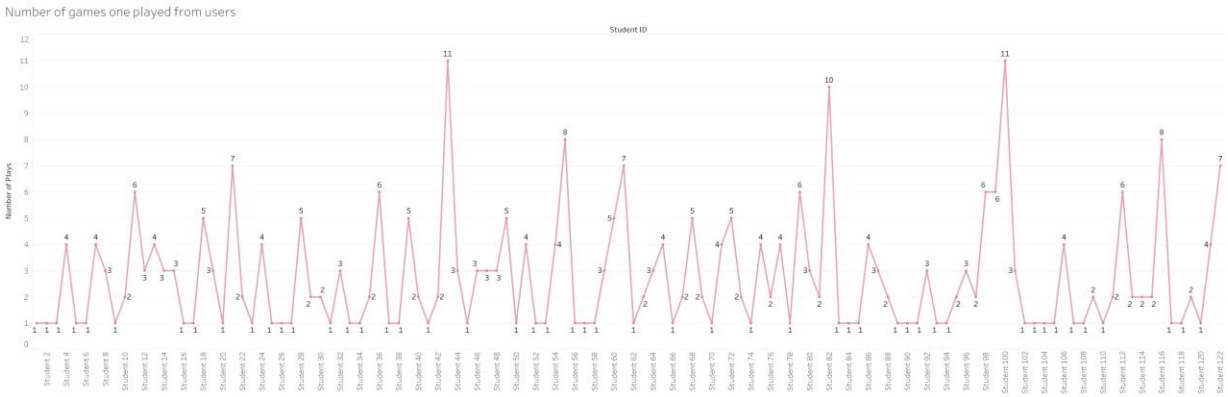


Figure 6. Student Game Play Record

## Future Research

In the future, the research team will focus on the following aspects:

1. Redesign the game based on feedback from middle school students, such as 1) Adding hints to player when it starts; 2) Provide notes or summary at the end of the game; 3) Implement battery power to the Walkie-talkie to indicate how many hints have been provided; 4) Add HU theme to the end credits; 5) Add music and sound in the game.
2. Upload the game to Google play store for public use.
3. Adding data log function to the game to better understand student behavior in the game.