

## **Title: Using Games with Story to Teach Computer Science Concepts in an Interdisciplinary Way**

### **Goals of the Session**

In this session, participants were introduced to analog games designed to help players develop an understanding of several core computer science (CS) concepts. The games are intended to be particularly appealing to teen age girls, and have been tested in a variety of informal educational settings, including libraries, after school programs, and summer enrichment workshops. These non-digital games develop students' understanding of CS concepts by engaging them in collaborative, story-driven, problem-solving experiences that enable them to think like computer scientists. In addition, the story element of the games can help teachers connect CS to a variety of different disciplines and subject areas, and promote computational thinking across the curricula.

Specific goals for the session:

1. Increase participants' general understanding of how games can be used to develop students' understanding of computer science concepts
2. Introduce participants to games that focus on three different CS concepts, each with a story to integrate the games into the interdisciplinary curricula
3. Give participants the opportunity to play one of these CS games and discuss how game play and story could encourage girls to elect to take a CS Principles course
4. Discuss how teachers might create or customize games for their own curricula
5. Provide participants with additional resources for classroom or after school events

### **Detailed Session Outline**

This session demonstrated how to use game play to introduce important computer science concepts and involve students in developing an understanding of these concepts in an active, experiential manner. Three non-digital games were introduced, each intended to teach one key computer science concept: algorithms, data management, and image representation. The games can be adapted to meet different curricular goals and time constraints; each game has several "levels" that can be played over one or more sessions, with about 60 - 90 minutes of total game play per game. The games to be used and discussed in the session were developed in a National Science Foundation-funded project<sup>1</sup> aimed at exploring how the use of stories might increase the appeal of CS games for middle school girls, thus increasing their engagement and learning.

Session activities included:

1. Introduction: The lead facilitator briefly introduced the rationale for game-based learning and for the specific computer science concepts we selected as the focus for our games, tying them to the Computer Science Principles curriculum from the College Board and the National Science Foundation.
2. Game Play Demo: The lead facilitator and co-facilitator provided an overview of the games selected for demonstration. Session participants were divided into small groups and each group had the opportunity to play one or two levels of the game. Presenters demonstrated how to facilitate game play and discussion. As an example, one game, "Capture a Villain," is a card game designed to engage players in applying the CS principle of organizing data in order to

search more efficiently. The story is about catching Poachers and Sellers of endangered animal species from every continent around the world. The players have to arrange the data cards about specific poachers and sellers, using organizing rule action cards, to capture the seller or poacher they have selected.

3. Discussion: The whole group was intended to be convened for Q&A, but due to the large audience, time ran out. Facilitators intended to describe the other games and findings from our game sessions with girls. We intended to discuss the game design process and how educators can modify these games or create their own games.

4. Takeaways: Participants can locate the project website, where they can read more about the game development process. They also can download facilitator guides and materials for all games discussed in the session. This is available at the work-in-progress site of <https://web.northeastern.edu/gramhouse/storyteach-project-description/storyteach-game-documents/>.

### **Expected Attendee Experience**

The games are not digital, and do not require any technical skills or prior knowledge to play. It would be helpful if participants are familiar with the College Board's Computer Science Principles curriculum, but that is not required.

### **Expected Benefits from this Presentation**

Participants benefitted from an increased understanding of game-based learning as a tool for introducing students to CS concepts. Participants gained insight into how story-driven games might have particular appeal for teen girls, a population that can be difficult to engage in CS courses. Benefits to participants also include access to game materials along with involvement in actual game play as a means of enhancing their own ability to facilitate game play in their own settings.

### **Description of Takeaways**

Participants will have access to digital copies of game materials and detailed facilitator guides for three complete games.

### **Presenter Background**

The lead presenter/facilitator, Professor Carolee Stewart-Gardiner, has been an Assistant Professor of Computer Science at Kean University. She has more than 25 years of teaching experience in undergraduate computer science, as well as many years of computing industry experience. Stewart-Gardiner has been the lead or organizing member of several Kean initiatives to enhance retention of women and other underrepresented groups in computer science, including CS4HS Workshops for CS teachers. Stewart-Gardiner and Elisabeth Gee of Arizona State University co-designed the games and related instructional activities that will be presented in this session. They conducted pilot testing and data collection at New Jersey and Arizona middle schools and held a teacher professional development workshop focused on CS Principles and these games in July 2016. Stewart-Gardiner was assisted by Abidemi Olaoye, a Kean undergraduate student who served as a research assistant on the project.

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<sup>1</sup> This material is based upon work supported by the National Science Foundation under Grant Numbers DRL-1421806. Any opinions, findings, and conclusions or recommendations expressed

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in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.