THE EDUCATION FUND

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2020-2021

Ideas With IMPACT

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Sphero Robots Used to Bring Coding to Life

Sphero (Spark+) Resources for Girls Who Code Club

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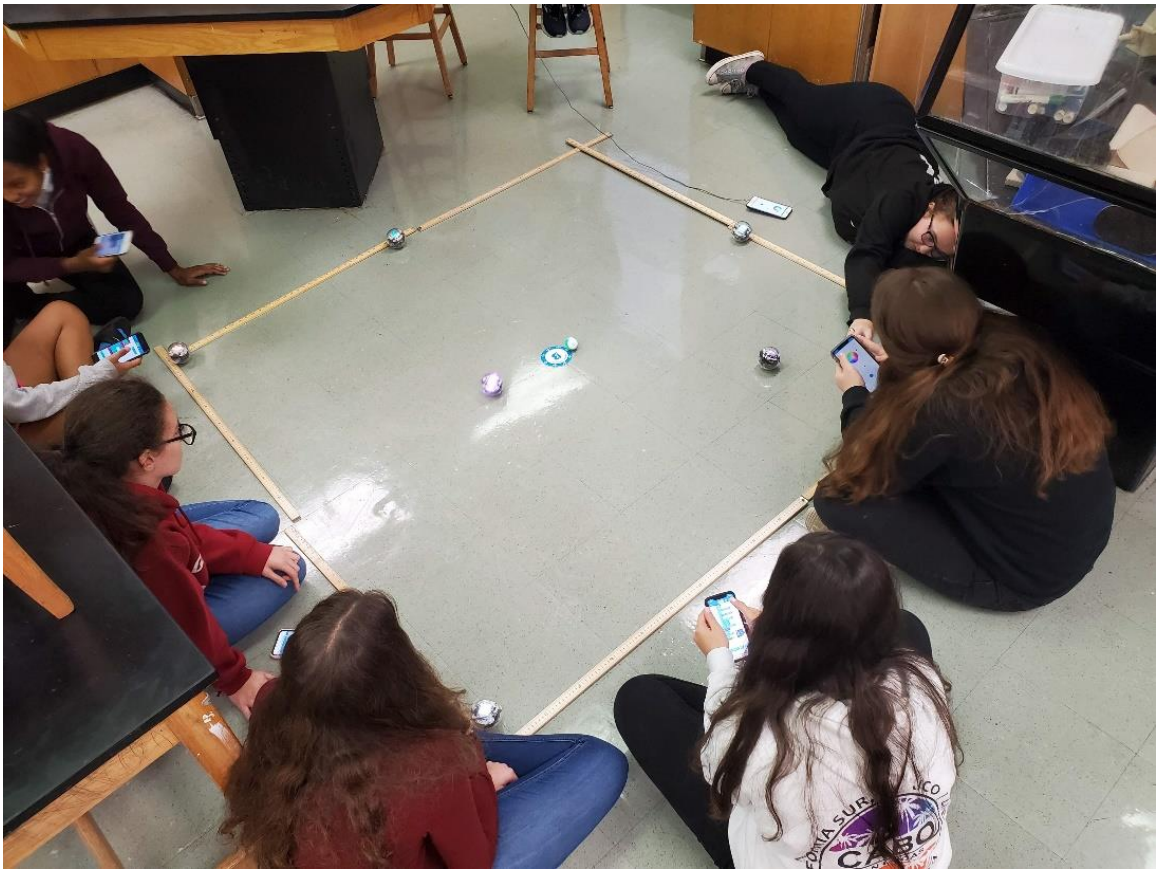

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Goals & objectives

Abstract

Students collaborated to write code and develop computational thinking skills necessary to compete in a global technologically rich economy. The Sphero robots used are a coding platform a self-contained robotics system that can be used by any teacher of student without any background in computer science. This project helps to close the gender gap in technology and changes the image of what a programmer looks like.

Goals

"The Bureau of Labor Statistics (BLS) projects that computer science research jobs will grow 19% by 2026. Yet, women only earn 18% of computer science bachelor's degrees in the United States. Despite the high job demand, computer science remains a male-dominated field in the United States. Additionally, the percentage of women working in computer science-related professions has declined since the 1990s, dropping from 35% to 26% between 1990 and 2013.

According to the American Association of University Women, we can reverse this trend by removing negative connotations around women in computer science. Educators and parents must work together to help girls maintain their confidence and curiosity in STEM subjects."
https://www.computerscience.org/resources/women-in-computer-science/

Since there is such a dichotomy in the number of girls taking AP and upper level science courses, I started the Girls Who Code club at our school, based on interest from my students who wished to be future engineers and scientists.

My project was innovative because it would provide my underrepresented students a 'real – life' application of their code. The Sphero materials would allow my students to create, fail, revisit, and apply their coding using a tangible, hand – on reinforcement via the robots. These robots would additionally serve to attract other students, especially underrepresented groups, to participate in these hands – on STEAM-based learning activities and creative challenges.

When the Educational Fund and Girls Who Code club supported this project, it helped to provide unrepresented young woman with the tools necessary to maintain their interests as well as allow them to hone their skills in becoming the next generation of computer scientists and engineers.

Sphero robot materials are the perfect platform to help my students "develop computational thinking skills and the mindsets that are necessary to compete in a global, technology-rich economy. Sphero robots serve as both a coding platform and self-contained robotics system that can be used by any teacher or student, without any background in computer science. In addition, Sphero has a sophisticated set of sensors (called an inertial measurement unit or IMU) used for measuring forces and gathering data during scientific experiments."

Objectives

Girls Who Code Meeting Goals ~ Standard Meetings Schedule ** Please note: These are the GWC curriculum goals from the GWC website which I followed*	
"Meeting #1	• *Describe the important qualities of a computer scientist.* • *Learn more about your peers and begin developing a sisterhood within your Girls Who Code community.* • *Describe what the Girls Who Code Project is and how it relates to Girls Who Code Project Tutorials.*
Meeting #2	• *Brainstorm and vote as a group for a topic or theme for their Girls Who Code projects.* • *Work on their GWC Project Tutorial and begin learning how to use their chosen tool and language.* • *Name a woman working in the tech field and reflect on her impact.*
Meeting #3	• *Learn more about your peers and continue developing a sisterhood within your Club.* • *Continue working on your GWC Project Tutorial by completing Part 1 and starting Part 2.*
Meeting #4	• *Reflection on the important qualities of a computer scientist by learning about a Woman in Tech.* • *Wrap up Part 2 and begin tackling Part 3 of your GWC Project Tutorials.*
Meeting #5	• *Learn more about your peers and continue developing a sisterhood within your community.* • *Practice giving and receiving feedback on your Girls Who Code Projects.* • *Wrap up Part 3 and begin tackling Part 4 of their GWC Project Tutorials.*
Meeting #6	• *Reflect on the important qualities of a computer scientist by learning about a woman working in the tech industry.* • *Continue work on Parts 4 and 5 of your GWC Project Tutorials and incorporate the revisions from peer feedback.*
Meeting #7	• *Test out different features or projects that other girls have built.* • *Make plans on how to improve your project based on the feedback from teammates.*
Meeting #8	• *Name a woman working in the tech field and reflect on her impact.* • *Wrapping up work on GWC Project and extensions.*
Meeting #9	• *Prepare for the Club's project launch party.* • *Wrap up your GWC Project and submit your work on the Project Gallery.*
Meeting #10	• *Continue building connections and Sisterhood by completing a Sisterhood Activity.* • *Name a woman working in the tech field and reflect on her impact.* • *Select and start a new GWC Project Tutorial."*

Florida Standards

Some of the Florida Standards that we worked on are:

SCIENCE STANDARDS	
SC.912.N.1.1	• *Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:* 1. ***Pose questions about the natural world,*** *(Articulate the purpose of the investigation and identify the relevant scientific concepts).* 2. ***Conduct systematic observations,*** *(Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).* 3. ***Examine books and other sources of information to see what is already known,*** 4. ***Review what is known in light of empirical evidence,*** *(Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).* 5. ***Plan investigations,*** *(Design and evaluate a scientific investigation).* 6. ***Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),*** *(Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, "probeware", meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).* 7. ***Pose answers, explanations, or descriptions of events,*** 8. ***Generate explanations that explicate or describe natural phenomena (inferences),*** 9. ***Use appropriate evidence and reasoning to justify these explanations to others,*** 10. ***Communicate results of scientific investigations, and*** 11. ***Evaluate the merits of the explanations produced by others.***
SC.912.N.1.7	• *Recognize the role of creativity in constructing scientific questions, methods and explanations.*
MATH STANDARDS	
MAFS.912.N-Q.1.3	• *Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*
MAFS.K12.MP.1	• *Make sense of problems and persevere in solving them*
MAFS.K12.MP.2	• *Reason abstractly and quantitatively.*
LANGUAGE ARTS STANDARDS	
LAFS.910.RST.3.9	• *Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.*
LAFS.910.RST.1.3	• *Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.*

COMPUTER SCIENCE ~ COMPUTER PRACTICES & PROGRAMMING STANDARDS	
SC.68.CS-CP.2.3	• *Develop problem solutions using a block programming language, including all of the following: looping behavior, conditional statements, expressions, variables, and functions.*
SC.68.CS-CP.2.4	• *Develop problem solutions using a programming language, including all of the following: looping behavior, conditional statements, expressions, variables, and functions.*
SC.68.CS-CP.3.1	• *Select appropriate tools and technology resources to accomplish a variety of tasks and solve problems.*
SC.68.CS-CP.3.2	• *Create online content (e.g., webpage, blog, digital portfolio, multimedia), using advanced design tools.*
SC.68.CS-CC.1.2	• *Apply productivity and or multimedia tools for local and global group collaboration.*
SC.68.CS-CC.1.3	• *Design, develop, and publish a collaborative digital product using a variety of digital tools and media-rich resources that demonstrate and communicate concepts to inform, persuade, and/or entertain.*

Course Outline/Overview

Girls Who Code Meeting Schedule ~ Standard Meetings Schedule	
Meeting #1	• *Welcome* • *Introduction to GWC* • *Introduction to coding tutorials*
Meeting #2	• *Coding Tutorials* • *Brainstorm Final Project Ideas*
Meeting #3	• *Coding Tutorials* • *Finalize Project Ideas*
Meeting #4	• *Coding Tutorials* • *Introduce the BOLT robots*
Meeting #5	• *Coding Tutorials* • *Begin coding BOLT robots(i.e. to get robots to preform)*
Meeting #6	• *Coding Tutorials* • *Coding BOLT robots*
Meeting #7	• *Coding Tutorials* • *Coding BOLT robots*
Meeting #8	• *Coding Tutorials* • *Coding BOLT robots*
Meeting #9	• *Final Touches on Final Project*
Meeting #10	• *Celebration & publish/video final project*

Lesson Plans and Step-by step guide in implementing

Girls Who Code Lesson Plans

Each GWC Meeting consists of the following sections:

- *Welcome & Meeting Preview/ Agenda*
- *Sisterhood Activity ~ Inspirational Video Clips of Successful Women in Computer Science*
- *Tutorials ~ Work on Coding tutorials and Sphero robots*
  The girls pick what computer program(s) that they wish to work on and what level they wish to work on each week. This provides the students with the ability to drive their own learning. It allows the students to actively pursue the knowledge and then use their discoveries with the group to help to create the group's overall final project.
- *Stand Up Section ~ Where the students take on the role of software engineers. Each girl must keep the group updated on their progress, thought, accomplishments, and needs for assistance.*

Please note the curriculum is proprietary for GWC and I cannot reproduce it here. However, the GWC materials are free to registered schools. Registration isn't difficult or time consuming and there is NO charge to have access to the materials once you register your group.

Our Final Product

Please check out our website for the video of our creation;

- *Our webpage is….* *https://gwcclub-fl20646.weebly.com/*
- *The project is shown on* *https://gwcclub-fl20646.weebly.com/2019-2020-project.html*.
- *If you click the "link to a video of our creation", you will see each girl using her coding to run the various robots.*
  https://drive.google.com/file/d/1pCyEj8bl0O8Zeasfqif5zmctP5CehIIT/view
- *On the bottom of the page, you can see the actual code that each girl created. Just click the link that you wish to view. For example ~ Grumpy's code* https://gwcclub-fl20646.weebly.com/uploads/1/2/9/6/129653512/gwc~grumpy.jpg

Pictures

Resource List

- *Girls Who Code*
  https://girlswhocode.com/

- *Girls Who Code Programs*
  https://girlswhocode.com/programs

- *Sphero ~ Sphero Computer Science Foundations Course 2*
  https://sphero.com/collections/all/products/csf2

- *Sphero BOLT (robotic ball)* **
  https://sphero.com/products/sphero-bolt?_pos=2&_sid=cdaf8bdc4&_ss=r

- *Sphero Turbo Cover (to protect the robots from scuffs and scratches when in operation)*
  https://sphero.com/products/turbo-cover?_pos=1&_sid=ecf5cbf73&_ss=r

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** *Due to the Christmas holiday, I was able to purchase the Sphero BOLT robots instead of the Sphero Spark+ robots. The Sphero BOLT robots are the newest version of the robots and have a digital screen that the students can code to manipulate. I also received the grant from GWC and was able to purchase the charging/carrying case for the robots as well.*
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