Grade: 1st
Program Title: "Robo Wunderkind: Design, Build, Test and Code Robots!"
Quarter: **2nd**
Number of hours: 2

Performance Expectations: K-2 EST1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.		
Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts
Analyze data from tests of an object or tool to determine if it works as intended. (K-2-ETS1-3)	**ET S1. B: Developing Possible Solutions Designs** can be conveyed through sketches, drawings. These representations are useful in communicating ideas for a problem's solutions to other people. **(K-2-ETS1-2)** **ET S1.C: Optimizing the Design Solution** Because there is always more than one possible solution to a problem, it is useful to compare and test designs. **(K-2-ETS1-3)**	**Structure and Function** The shape and stability of structures of natural and designed objects are related to their function(s). **(K-2- ETS1-2)**
Maryland College and Career-Ready Standards (MD-CCRS)		
ELA/Literacy	CCRS-RELA: **SL.2.5** Create drawings to clarify ideas, thoughts, and feelings. **(K-2-ETS1-2)**	
Mathematics	Measurement in cm	
Computer Science	**1A-CS-01** Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use. **(P1.1**)	

Program Title:	**"Robo Wunderkind: Build, Test and Code Robots!"**
Lesson Objective(s)	Visiting students will select, build, test, and code Robo Wunderkind Robots for specified science missions and compare robotic mission success.
Resources/Materials	**HBOSC Instructor:** Robo Wunderkind Instructor ppt. Instructor iPad connected to the Box Light Board, Robot Wunderkind Instructor Parts Tray, Student Task Directions for Building, Testing and Coding (4) Different Robo Wunderkind Robots. **Student Tables:** Table Robo Wunderkind Parts Kits, Student Task Directions for

	Building, Testing and Coding Robo Wunderkind Robots and iPad3's with Robo Coding and Live Software apps, student booklets and pencils.

Engagement (10 min): Activities capture the students' attention, connect their thinking to the situation, and help them access prior and current knowledge. Students may experience a new phenomenon or reflect on an anchor phenomenon.

Welcome students to the Science Center's ***New*** "***Robo Wunderkind Robotics Program***". Follow-up on the Pre-Visit Activities sent to the school prior to today's field trip showing students 1-3 of the ppt. pictures of real-world robots and asking them to identify what they think the robot has been programmed to do. Also, ask students to identify the parts observed on the robot that make it possible for the robot to complete its programmed task(s). Finally, invite students to share information about the robot they designed or would want to have, specifically, what the robot would do and parts the robot would need to have to perform the desired task(s). Then introduce today's task of building and programming ***Robo Wunderkind*** robots as a team for t and compare robot functions to explore the surface of Mars and compare robot functions.

Exploration (20 min): Activities allow students to investigate initial ideas and solutions in meaningful contexts.

Exploring Robo Wunderkind robot parts and programming coding app functions. **Through instructor led exploration activities visiting students will program Robo Wunderkind sounds, lights, push button and distance sensor.**

Assign student team table job #s 1-4 and explain that the students will take turns building and coding a *Robo Wunderkind r*obot. Let students know that before building a robot you want to familiarize them with the *Robo Wunderkind* robot parts available and programming coding actions.

Invite student # 1 to place the orange "Main Block" onto the team's center green building tray. Let students know that the orange "Main Block" (ppt. slide) is a mini computer with speakers and provides power to *Robo Wunderkind* parts that need it. Invite student # 1 to find the bottom "power switch" and slide it to the "on" position. A light (blue or green) should come on and it will make a sound (ppt. slide)

Invite student # 2 to open the **red** "**Robo Coding App**" on the iPad by tapping it once (ppt. slide). Inform students that their Robo robot has the same # as their table (ppt. slide). For example, table one is "Robo1". Table 2 is "Robo2". Ask student # 2 to please tap on their table's "Robo #" robot name" and then tap the green "connect" button to "pair" the Orange "Main Block" robot computer with the iPad so that their Robo Wunderkind Robot can receive picture program codes from the team for what they want their robot to do. Ask student # 2 to also tap the red "sunshine" icon and then the "New Project" **green** **+** sign (ppt. slide).

HBOSC Instructor: Identify menu picture icon features observed on the iPad screen such as the bottom dock coding categories, the connect symbol for connecting codes, the play arrow button and trash can for deleting programs when finished (ppt. slide).

Invite student # 3 to tap the "music note" sound icon coding category located in the bottom of the screen dock. Share with students that these pictures represent the sounds that Robo Wunderkind's Main Block speaker can play. Model for students how to drag a sound to the blue programming board and then press play to hear the programmed sound. Then, starting with student # 3 invite each student to drag and play a sound. When all students have finished (hands in lap), model for students how the three dot "connection tool" can be used to connect and play multiple sounds.

Invite student # 4 to tap the 3 dot "connection tool" located at the bottom left of the screen and then use their finger to draw lines connecting the team sounds and then to tap the top right "play arrow" button. After the sounds are heard student # 4 should press the red/white square "stop button". Model for students how to delete programs using the "trash can" by tapping it and the objects to be deleted on the screen and then touch the screen anywhere to return to the blue ready to program screen. Invite student # 4 to trash/delete the programmed team sounds.

Invite student # 1 to find the "Yellow light" from the Robo Wunderkind parts and attach it to their teams orange Main Block. Share with students that Robo Wunderkinds "Yellow Light" button can be programmed to show different colors of light. Model for students how to tap the light icon in the dock, drag a continuous light to the board, select a color and press play. Then starting with student # 1, invite each member of the team to do the same. Once finished, model for students how to use the connection tool to program more than one light and invite student # 1 to use the connection tool to connect the teams' programmed lights and to press play to implement their teams' light program. Model again how to use the trash can to clear the programming board and ask # 1 to clear their teams' board.

HBOSC Instructor: Introduce students to the blinking light function also located in within the light icon dock category. Model for students how to: 1) Drag a blinking light symbol to the board, 2) set the color as before and 3) how to use the slider to set a desired number of sequenced light blinks and 4) press the "play arrow" to observe the programmed blinking light sequence.

Starting with student # 2, invite each of the students to program and play a blinking light. When teams have finished inquire from students how to create a program using each of the students programmed lights? (connection tool). Invite student # 2 to please connect and the teams' lights and run the program. When finished inquire from students how to clear the program from the board (trash icon) and invite student # 2 to clear the board.

Invite student # 3 to attach the "**red button**" to the orange "Main Block". Invite student number 3 to drag, set the color and connect two continuous lights and to press the "play arrow" button for the team to observe.

HBOSC Instructor: Using the "connection tool", model for students how to create a "loop" by drawing a second line from the second light back to the first and then press the "play arrow". The lights should continue to "loop" in lighting back and forth until stopped by pressing the "stop button".

Invite student # 3 to use the "connection tool" to create a "loop" for their teams' previously programmed lights and then should press the "play arrow". After student tables have observed the loop, direct student number 3 to tap the "stop" button.

HBOSC Instructor: Model for the students how to add two button triggers to their two light loop program by tapping the "exclamation" trigger category icon in the dock and then dragging and placing a "button" picture to the connection line going from the first light to the second and then drag another button to the connection line going from the second light to the first light. Press "play" and model for students how the buttons must be pushed for each light to light.

Invite student # 3 to add "push button" triggers to their teams' lights and then to press the "play arrow". Each member of the team starting with student # 3 should try out the buttons. When finished, student # 3, should press the "stop" button and request student # 3 to trash the items on the programming board.

HBOSC Instructor: Hold up a "green connector" (also ppt. slide) and let students know that it is used to connect Robo module blocks together and has metal for parts the need electric power.

Invite student # 4 to attach a green "connector" to the left end of the orange "Main Block" (ppt. slide).

HBOSC Instructor: Hold up and show students the red "Robo Wunderkind Distance Sensor (also ppt. slide) and share with students that the sensor "eyes" can measures how far away objects are from the robot.

Invite student # 4 to attach Robo Wunderkind's "Distance Sensor" to the green "connector" at the end of the orange "Main Block" as shown in the next power-point slide. Invite student # 4 drag a light set to a color of choice and a sound to the blue programming board. Direct student # 4 to connect the sound and light using the 3 dot "connection tool". Invite student # 4 to add a light to the sound circle and set the color.

HBOSC Instructor: Model for students how to add a "distance sensor trigger" to student # 4's program so that the robot will light and make a sound when an object is 50 cm near its sensors by tapping the Trigger category "Exclamation" icon in the dock and dragging the "distance sensor's brick wall trigger" to the white connection line near the first light. Press play and move your hand near the Robo Wunderkinds "Distance Sensor" eyes. The light and sound should be observed each time your hand is within 50 cm of the Robo Wunderkind robot.

Invite student # 4 to add a "Distance Sensor" trigger to their program and then should press the "Play Arrow Button. Then, starting with student # 4, each student should take turns moving their hand in front of the distance sensor eyes to experience how the programmed trigger works. When finished, share with students how the distance sensor trigger can be set for different distances by tapping on the programmed "brick trigger" and using the slider to change and set a new distance trigger. Invite student # 4 to change and table test the new distance. When finished, invite student # 4 to tap the "Stop" button and request the student "trash" the current program.

Invite student # 1 to turn of the power to the orange "Main Block" by sliding the power button to the other side. (ppt. slide).

HBOSC Instructor: Introduce and model for students how to use the blue "disconnect or tool" to disconnect Robo Wunderkind robot parts **on each side**. Direct student teams, starting with student # 1, to take turns disconnecting Robo Wunderkind parts and to put them away.

Ask students if they have any questions about the Robo Wunderkind robot parts before they start building a complete Robo Wunderkind Robot. Answer student questions. (Students might need a quick movement break before team building their robots).

Explanation (30 min): Students develop an explanation for the concept and practices. Teacher's descriptions and definitions help clarify and modify students' understanding of the lesson.

Student Table Teams Will Select or Design a Robo Wunderkind Robot to Build, Test and Code to explore the surface of Mars and compare robot functions.

HBOSC Instructor: Show students a real landscape of the planet Mars (ppt. slide) and inform students that NASA is using robots right now to explore the surface of Mars to learn about it before humans go there and that their task today is to build a robot designed to explore Mars and to test its robot parts.

Advance the ppt. slide to show students the pictures and names of the three robots that their team can build either an: 1) Obstacle Avoidance ROVER, 2) "Habitat Distance Alarm Robot", 3) "Light Bot ROVER or the team may 4) design one of their own. Let the team discuss and decide which ROVER they would like to build.

Once decided, share with students how now they will become Engineers and will keep their job numbers. Student # 1 is now "Engineer # 1". Pass out to student teams direction for the robot they have chosen to build and direct their attention to the word and picture directions for the task they are to complete still in 1,2,3 4 taking turns order until their robot is built (ppt. slide).

HBOSC Instructor: Monitor and provide guidance as needed to assist students in building their team robot.

Elaboration (30 min): Activities provide students with opportunities to expand and apply their understanding of the concepts within new context and situations.

Student Teams will code and test their built Robo Wunderkind Robot part functions.
When a team has finished building, provide them a second iPad and working in student pairs to use the "ROBO Coding" app to program and test their robot's functions on the floor under their table.

Evaluation (15 min): Students analyze their understanding of the concepts, and teachers have the opportunity to assess student learning.

Evaluation will be on-going throughout the lesson by the HBOSC instructor evaluating student responses, ability to build and code their team's Robo Wunderkind Robot. Students will evaluate and report their team's robot success for completing student parts programmed test tasks and as a class will compare robot functions to determine the best robot(s) to recommend to NASA to explore the surface of Mars. The visiting teacher will be provided the HBOSC On-line program evaluation to evaluate the HBOSC Robo Wunderkind program.

Closure: (15 min)

Student teams will take turns in 1-4 # order to use the blue disconnection tool to carefully disassemble their teams' Robo Wunderkind robot and put the parts away. Then, the HBOSC instructor will summarize what the students did during their visit and highlight the "Program a Robot to Dance" activity provided to the visiting teacher in the "Robo Wunderkind" Post-Visit Resource packet to assist the students in continuing to learn about computer science robotics back at their school or home. The HBOSC instructor should also Invite the students and other visitors to return to HBOSC for the Spring Open House and dismiss the students.

Modifications and Accommodations:

Refer to the PGCPS UDL website to identify specific strategies or technologies to address specific needs of individual students: http://www1.pgcps.org/udl

- Advanced Learners
  - Should select to build the "Obstacle Avoidance Rover" which uses the most parts.
- English Language Learners
  - Allow read aloud of all written text
  - Have students provide oral responses to their questions
  - Picture Directions are included with the build directions.
  - Students should be paired with students who can translate and read directions easily.
- Students with Disabilities
  - Pair with strong team/partner
  - Guide to picture building directions.
  - Model coding as needed.

Program Lesson Created by: Sallie M. Smith, HBOSC Robo Wunderkind Program Lead, Fall 2019.