

Capstone Project: Block Coding and Remote Controlled Robots Challenge

Course Syllabus



Developed by:
Bridgett Williams
W003bbw@gmail.com
Summer 2018

TABLE OF CONTENTS

Table of Contents.....	2
1. Introduction.....	3
2. Materials.....	4
2.1. Online Block Coding With Tynker and Scratch.....	4
2.2. Robots And Supplies	4
3. Project and Guidelines	5
3.1. Introduction to Block Coding	5
3.2. Grouping, Challenge, and Rubric.....	10
3.3. Robot Poster Design.....	12
3.4. Resource	14
3.5. Bibliography	15

1. INTRODUCTION

The purpose of this syllabus is to provide a 10 week capstone project that introduces basic block coding and utilizes remote controlled robots. This capstone is ideal for middle school STEM classes, but can also be utilized by non-STEM classes as well. Note that this syllabus was created by a middle school technology teacher who sought out a project to complete the school year after state testing exams were over.

This syllabus has a 10 week schedule, but can be modified to fit a 5 week schedule. If utilizing the syllabus for a 10 week program, it is suggested that the first 5 weeks be dedicated to using the online coding programs Tynker™ and Scratch™ to teach basic block coding.

Tynker™ “makes it easy to teach computer programming. The curriculum is organized into grade-specific courses where students move at their own pace through scaffolded lessons to learn concepts and apply them creatively”. Tynker™ accounts for teachers are offered for free, with an option to purchase a full curriculum; however, the basic free lessons will meet the needs of this syllabus. Those free lessons will be outlined in the day to day activities below. Click the link to access Tynker: <https://www.tynker.com/#/>

Scratch™ “is a program where students can use basic codes to create their own interactive stories, animations, and games. In the process, they learn to think creatively, reason systematically, and work collaboratively — essential skills for everyone in today’s society”. Scratch™ accounts for teachers are free but must be requested. It has endless projects and examples for students to learn block coding. In the following project, Scratch™ will be used after Tynker™.

The remote controlled robots utilized in this capstone project are Ozobot, Mblock, BB-8 and Ollie. A total of 12 robots were on loan to this class by The Gaming Research Integration for Learning Lab® (GRILL®) under the Air Force Research Lab Division for the purpose of testing and creating the capstone project. The robots vary in cost, but can be found from a number of locations and compared for best price. The robots need access to Bluetooth to operate on touch screen tablets or cell phones. Students can also use their personal cell phones to operate the robots if tablets with touch screen are not available. Not all robots will need to operate with a cell phone or tablet which will be discussed in the Materials section of this syllabus.

An assessment is necessary for differentiation purposes. Since students will demonstrate various levels of understanding or experience with coding a basic assessment is provided to gauge where students might fit on the spectrum of understanding. If there is another

assessment that will work for your curriculum feel free to use it in place of the basic assessment provided.

Your assessment will provide key information needed to modify some lessons with individualized instructional needs. There are several resources provided in the block coding programs to help with meeting modifications. Lessons listed in the day to day activities will offer some suggestions as well.

Placing students in groups will help students who are struggling with understanding coding blocks and creativity for the challenge. The grouping also meets the criteria needed to meet the Ohio Learning Standards for Technology listed below.

Completed lessons in the online coding programs provide both formative and summative assessments. In addition, throughout the 10 weeks, teacher and student interaction provide opportunity for formative assessments as well.

Students are required to keep a log book to record daily activities such as analysis of lesson completion, ideas, recording of blocks learned and other task-related information. The logbook can be created through a computer application document such as “Google docs” or a hard-copy composition notebook.

Ohio Learning Standards for Technology:

Strand: Design and Technology

Grade 6-8 Topic 3: Demonstrated that solutions to complex problems require collaboration, interdisciplinary understanding, and systems thinking. **Focus:** Collaborate to solve a problem as an interdisciplinary team modeling different roles and functions.

Additional standards are addressed in each lesson for the online programs for math, ELA and science.

2. MATERIALS

2.1. ONLINE BLOCK CODING WITH TYNKER AND SCRATCH

- Computer with internet access for each student
- A basic log book for keeping track of daily activities

2.2. ROBOTS AND SUPPLIES

This section includes a list of the robots suggested for this capstone project with a brief description of their capabilities. In addition, there is suggestive student pairing with students’ strengths and weakness:

- “Ozobot Bit – Uses optical sensors to read lines and OzoCodes—short color code sequences—drawn with markers and paper.” OzoCodes Link: <https://play.ozobot.com/print/guides/ozobot-ozocodes-reference.pdf>
Suggested for those students who are artistic, very detailed or who like to draw/doodle.
- “Evo™— is a smart and social robot that teaches kids to code while connecting them with friends. Suggested for those students who are advanced with technology.”
- “Mblock™—Entry level educational robot. Assembly required. Comes with remote and can also be used with block based programming. Suggested for those students advanced in block coding.” Students with low creativity skills can use the remote control feature because there are not too many commands to think about when maneuvering the robots.
- “*Star Wars* BB-8™—The app-enabled Droid™ is an adaptive personality that changes when engaged in play. Based on interactions, BB-8 will show a range of movements and displays.” Suggested use for those students who have good hand and eye coordination. Typically your video gamers prefer this robot.
- “Sphero Ollie™— the app-controlled robot. Spin, drift, and flip with app-powered tricks. Ollie is engineered for speed, programmed for tricks, and can be customized. Build your own courses and jumps, master your skills, and then create custom trick combinations. Ride outside and own the streets with Nubby Tires or head indoors and hit the floors to drift like a pro. Ollie pairs instantly to your smart device via Bluetooth LE and is powered by USB charging” – Suggested use for those students who have good hand and eye coordination. Typically video gamers prefer this robot.
- Touch screen tablets
- Cell phone (students’ personal phones)

3. PROJECT AND GUIDELINES

3.1. INTRODUCTION TO BLOCK CODING

- Day 1 Introduce students to coding with an introductory video: “Coding Stars” Short film <https://www.youtube.com/watch?v=dU1xS07N-FA>
- Class Activity** – Peanut Butter and Jelly Sandwich Assessment Activity. (Sample 1)
- Instruction** – Complete assessment, Guidelines, administer logins, log into Tynker™
- Resource** – Tynker™ <https://www.tynker.com/dashboard/teacher>
- Day 2 **Class Activity** – Tynker™: Welcome To Tynker™
- Instruction** – Use guided tutorials and build a simple game. Create log books, demonstrate expectations and record username and password in logbooks.
- Resource Document** – Tynker™ www.tynker.com , Google Docs and Mark Zuckerberg video <https://code.org/educate/videos>
- Day 3 **Class Activity** – Tynker™: Candy Quest
- Instruction** – Project lesson on projector screen. Circulate around the room and help as needed. Bill Gates video : <http://code.org/educate/videos>
- Assignment** – logbooks, record new blocks, challenges, successes.
- Day 4 **Class Activity** – Tynker™: Animated Card Creator
- Instruction** – Invite students to share animated card with the class.
- Assignment** – logbooks, record new blocks, challenges, successes.
- Day 5 **Class Activity** – Tynker™: Comic Creator
- Instruction** – Encourage students to explore different features and to add speech bubbles. Early finishers can continue expanding their comic or make a new comic. Invite students to share their comic.
- Assignment** – logbooks, record new blocks, challenges, successes.
- Day 6 **Class Activity** – Tynker™: Dragon Dash
- Instruction** – Circulate around the room and help as needed. Project lesson on projector screen. Modification: partner students for additional help.
- Assignment** – logbooks, record new blocks, challenges, successes.
- Day 7 **Class Activity** – Tynker™: Pattern Maker
- Instruction** – Circulate around the room and help as needed. Project lesson on

projector screen. Modification: partner students for additional help.

Assignment – logbooks, record new blocks, challenges, successes.

Day 8 **Class Activity** – Tynker™ /My Projects/Create/project 1 (students choice)

Instruction – Walk students through tabs for accessing the create page. Check for understanding through project completions.

Assignment – logbooks, record new blocks, challenges, successes.

Day 9 **Class Activity** – Tynker™ /My Projects/Create/project 2 (students choice)

Instruction – Circulate around the room and help as needed. Check for understanding through project completions.

Assignment – logbooks, record new blocks, challenges, successes

Day 10 **Class Activity** – Tynker™ /My Projects/Create/project 3 (students choice)

Instruction – Circulate around the room and help as needed.

Assignment – logbooks, record new blocks, challenges, successes.

Day 11 **Class Activity** – Tynker™ /My Projects/Create/project 4 (students choice)

Instruction – Circulate around the room and help as needed.

Assignment – logbooks, record new blocks, challenges, successes

Day 12 **Class Activity** – Tynker™ /My Projects/Create/project 5 (students choice)

Instruction – Circulate around the room and help as needed.

Assignment – logbooks, record new blocks, challenges, successes.

Day 13 **Class Activity** – Log into Scratch™ Accounts/Explore

Instruction – Scratch™ introduction video:

<https://www.youtube.com/watch?v=ywG6lv9mFLI>

IMPORTANT

Print out the following guide, it includes assignments and handouts needed for Scratch™ activities.

Curriculum Guide for the following assignments:

<http://scratched.gse.harvard.edu/guide/files/CreativeComputing20141015.pdf>

Assignment – Record username and password in logbooks.

- Day 14 **Class Activity** – Scratch™ Unit One: Step by Step
- Instruction** – Step by Step handout. Step by Step studio:
<http://scratch.mit.edu/studios/475476> Help students sign in. Link to scratch cards: <http://scratch.mit.edu/help/cards>
- Assignment** – Respond to the reflection prompts listed in the lesson. Write your response in logbooks
- Day 15 **Class Activity** – Scratch™: 10 Blocks
- Instruction** – 10 Blocks handout. 10 Blocks studio:
<http://scratch.mit.edu/studios/475480> Circulate around class provide help if needed.
- Assignment** – Respond to reflection prompts in logbooks.
- Day 16 **Class Activity** – Scratch™: Debug it!
- Instruction** – Debug it! Handout. Unit 1 Debug It! studio:
<http://scratch.mit.edu/studios/475483> Class list of debugging strategies from students.
- Assignment** – Respond to reflection prompts in logbooks.
- Day 17 **Class Activity** – Scratch™ About Me
- Instruction** – About Me handout. About Me studio:
<http://scratch.mit.edu/studios/475570> Circulate around class provide help if needed. Also provide help card link: <http://scratch.mit.edu/help/cards>
- Assignment** – Respond to reflection prompts in logbooks.
- Day 18 **Class Activity** – Scratch™ Unit Two: Build a Band.
- Instruction** – Build a Band handout. Build a Band studio:
<http://scratch.mit.edu/studios/475523> Circulate around class provide help if needed.
- Assignment** – Respond to reflection prompts in logbooks.
- Day 19 **Class Activity** – Scratch™: Orange Square, Purple Circle
- Instruction** – Orange Square, Purple Circle handout. Orange square, purple circle studio: <http://scratch.mit.edu/studios/475527> Have student share design.
- Assignment** – Respond to reflection prompts in logbooks.
- Day 20 **Class Activity** – Scratch™: It's Alive!

Instruction – Show It’s Alive! Studio: <http://scratch.mit.edu/studios/475529>

Complete It’s Alive handout.

Assignment – Respond to reflection prompts in logbooks.

Day 21 **Class Activity** – Scratch™: Music Video

Instruction – Show examples from Music Video studio:
<http://scratch.mit.edu/studios/475517> Music Video handout.

Assignment – Respond to reflection prompts in logbooks.

Day 22 **Class Activity** – Scratch™ Unit Three: Characters

Instruction – Characters handout. Character studio:
<http://scratch.mit.edu/studios/475545>

Assignment – Respond to reflection prompts in logbooks.

Day 23 **Class Activity** – Scratch™: Conversations

Instruction – Conversations handout. Penguin Joke starter project:
<http://scratch.mit.edu/projects/10015800> Conversation studio:
<http://scratch.mit.edu/studios/475547>

Assignment – Respond to reflection prompts in logbooks.

Day 24 **Class Activity** – Scratch™: Scenes

Instruction – Scenes handout. Scenes studio:
<http://scratch.mit.edu/studios/475550>

Assignment – Respond to reflection prompts in logbooks.

Day 25 **Class Activity** – Scratch™: Pass It On

Instruction – Pass It On handout. Pass It On studio:
<http://scratch.mit.edu/studios/475543> Projector and screen to present student work.

Assignment – Respond to reflection prompts in logbooks.

3.2. GROUPING, CHALLENGE, AND RUBRIC

Introduction

Show the *Star Wars* trailer video below to create interest and imagination for development of challenge and logo poster: <https://www.youtube.com/watch?v=QOCbN8sfihY>

Grouping

Divide students into groups of 4. Assign a robot to each group. Provide students with instructions on how to take care of the robots. Additionally, students will need instructions on how to work in groups and deal with conflict resolutions. Allow groups to meet for an allotted amount of time daily with robots.

The Challenge

- 1) Each group will design a course for their assigned robot. Props such as cones, toy action figures can be used.
- 2) Demonstrate maneuverability and speed of robot at various degrees utilizing the remote control or cell phone.
- 3) Each person in the group must play a role in robot demonstration.
- 4) Create poster with design course and challenge. Include props, assignments of each member in the group – (see Figure 1).
 - a) Students can bring to school props.
- 5) Sign up to present.
 - A. 90 second demonstration with all members present.
 - B. Must write in rubric each person assignment and responsibility

Note: Groups should be allow 15-20 minutes per day to practice their challenge and to reflect in their logbooks.

Rubric for Robot Challenge

Category	Components	Points Earned	Comments
Robot: Challenge	Demonstrate maneuverability and speed of robot at various degrees utilizing the remote control or cell phone	70 pts	
Creativity in layout and design	Props matches theme and aids in challenge	10 pts	
Poster Design	Identifiable poster and provides a description of the challenge.	30 pts	
Total		100 pts	10 extra credit pts can be added for exceptional design
<i>Teammate 1</i>	Responsibility:		
<i>Teammate 2</i>	Responsibility:		
<i>Teammate 3</i>	Responsibility:		
<i>Teammate 4</i>	Responsibility:		
Presentation Date:			

3.3. ROBOT POSTER DESIGN

Step One: Group chooses one of the *Star Wars Logos* below to recreate on a poster.



Figure 2. STFU. Star Wars: TM & © Lucasfilm Ltd. All Rights Reserved.
<https://upload.wikimedia.org/wikipedia/commons/2/2d/SWTFU.png>



Figure 3. Darth Vader. Star Wars: TM & © Lucasfilm Ltd. All Rights Reserved.
http://pngimg.com/uploads/darth_vader/darth_vader_PNG23.png



Figure 4. BB-8. Star Wars: TM & © Lucasfilm Ltd. All Rights Reserved.
http://pngimg.com/uploads/starwars/starwars_PNG6.png



Figure 5. Trooper. Star Wars: TM & © Lucasfilm Ltd. All Rights Reserved.
http://pngimg.com/uploads/stormtrooper/stormtrooper_PNG33.png

More Creative Star Wars Ideas: The link provides a step by step video on how to create *Star Wars* characters: <https://www.youtube.com/watch?v=GMgpClgtVLU>

Step Two:

Follow the steps below to create your logo poster:

1. Paint or draw the entire poster
2. Recreate the logo selected above
3. Let the poster sit for a day if painted
4. Add additional artifacts like planets, planes rocks (might also create artifacts from construction paper, tissue paper, Styrofoam).

(Poster boards can be purchase at stores that sell items for a dollar. Various metallic permanent markers should be purchased.)

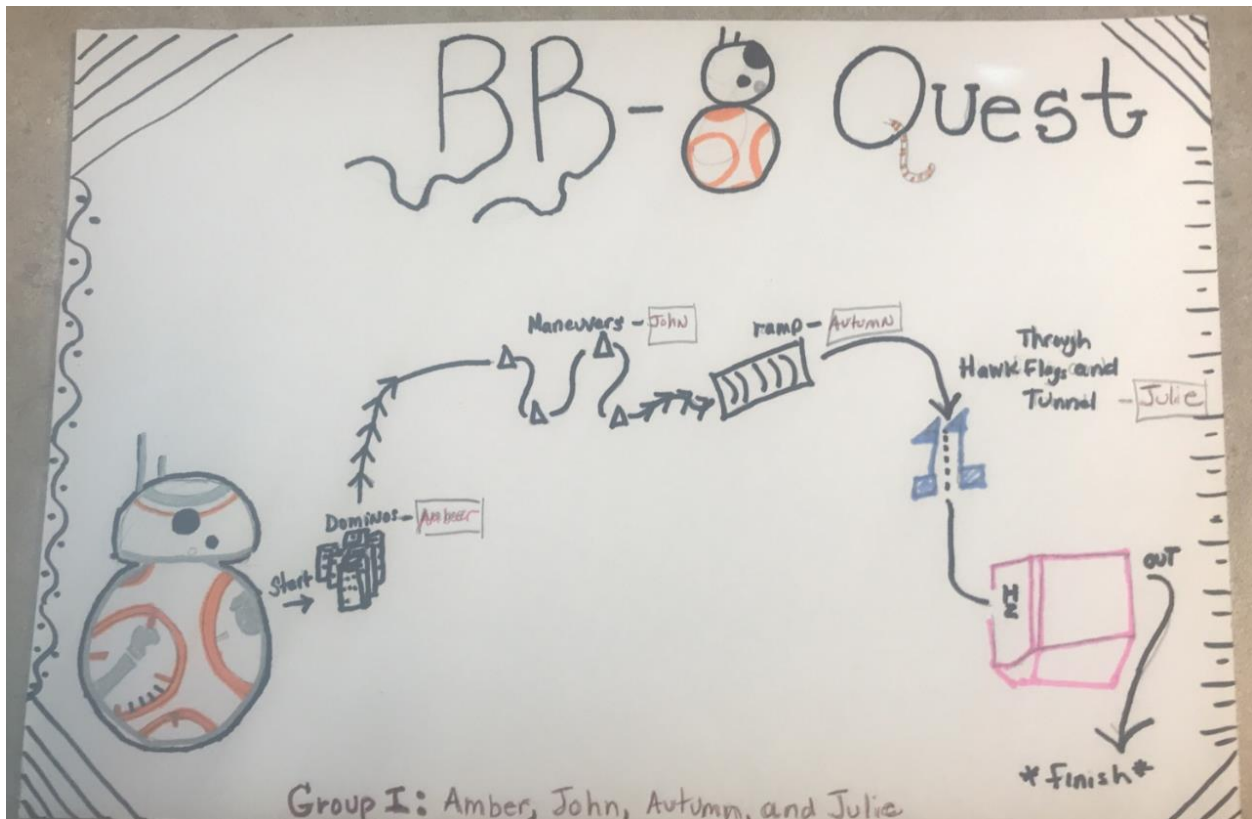


Figure 1. Example of Group Poster. Courtesy of Bridgett Williams

3.4. RESOURCE

Provided in this section is an assessment used to initially assess students' understanding of block coding.

Sample 1:

Peanut Butter and Jelly Assessment:

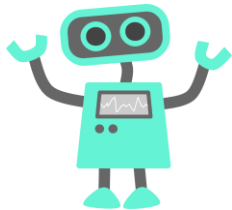
(Assess students before coding projects to build an understanding of how coding works.)

Students write instructions for a robot to follow on how to make a Peanut Butter and Jelly sandwich.

Name _____ Period _____



Hey Robbie the robot...please make me a peanut butter and jelly sandwich.



...Sorry, I don't understand. Help me understand, write out the steps you want me to follow below:

3.5. BIBLIOGRAPHY

1. Tynker™ <https://www.tynker.com>
2. Scratch™ Lifelong Kindergarten Group at MIT Media Lab <https://scratch.mit.edu/>
3. Ohio State Standards. <http://education.ohio.gov/Topics/Learning-in-Ohio>
4. Code.org via YouTube
5. Figure 5 courtesy of Bridgett Williams, produced at GRILL
6. Sample assessment created by Bridgett Williams, at Baker Middle School