THE EDUCATION FUND

FOR EXCELLENCE IN MIAMI-DADE PUBLIC SCHOOLS

2017-2018

Ideas with IMPACT

idea packet

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Art + Coding = Math Success!

Art + Coding = Math Success

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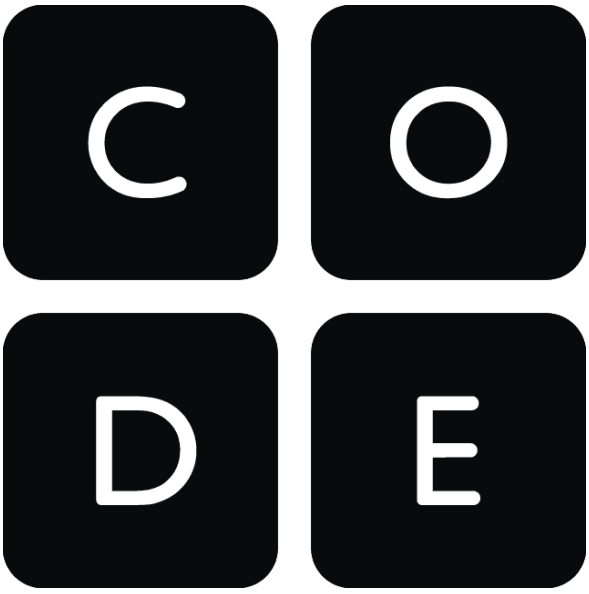
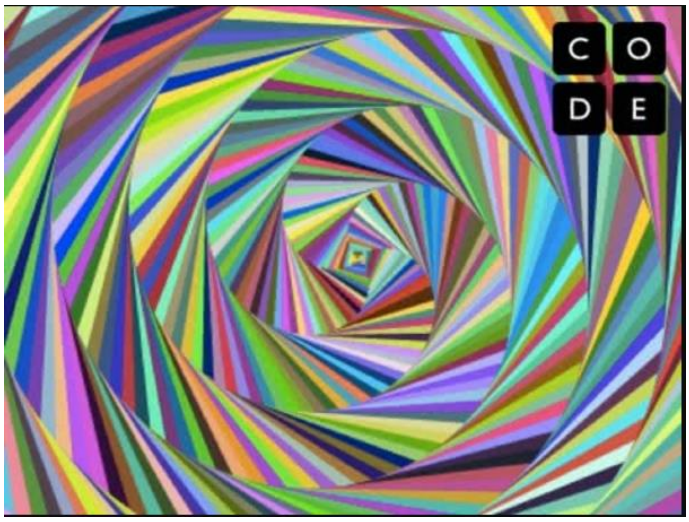


Goals and Objectives

The source of my idea came from the need to help students understand and succeed in math through art and computer science coding. Abstract math concepts can be a challenge to many students. When students struggle in mathematics they often get frustrated which leads them to simply give up trying and feel incapable of succeeding (Maitland, 2013). The goal of my project was to improve student mathematical abstract thinking by using the Studio Art lessons from Code.org. Programming is a real-world way to teach mathematical abstract concepts and thinking. When students create, or debug a program, they practice problem solving skills necessary to succeed in today's technological world. With the adoption of the Common Core State Standards (CCSS) in Florida, teachers are not only teaching core subjects such as Reading, Math, Science, and Social Studies, but also preparing their students to enter a world in which colleges and business are demanding more than ever before. According to Werrell (2014), "Coding is the new literacy. To thrive in tomorrow's society, young people must learn to design, create, and express themselves with digital technologies." I have seen firsthand how coding has ignited a passion for student learning like never before.



Mathematics Florida Common Core Standards 1st - 3rd Grade

Domain: MAFS.2.OA Operations and Algebraic Thinking

1.OA.1 - Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations.

2.OA.1 - Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions.

3.OA.3 - Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities.

Domain: MAFS.2.G Geometry

1.G.A.1 - Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.

1.G.A.2 - Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.

2.G.A.1 - Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces.

3.G.A.2 - Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.

CSTA K-12 Computer Science Standards

CT.L1:3-01. Use technology resources (e.g., puzzles, logical thinking programs) to solve age appropriate problems.
CL.L1:3-02. Work cooperatively and collaboratively with peers teachers, and others using technology.
CPP.L1:6-05. Construct a program as a set of step-by-step instructions to be acted out.
CPP.L1:6-06. Implement problem solutions using a block-based visual programming language.
CT.L2-01. Use the basic steps in algorithmic problem solving to design solutions.
CT.L2-06. Describe and analyze a sequence of instructions being followed.
CT.L2-08. Use visual representations of problem states, structures, and data.
CT.L2-12. Use abstraction to decompose a problem into sub problems.

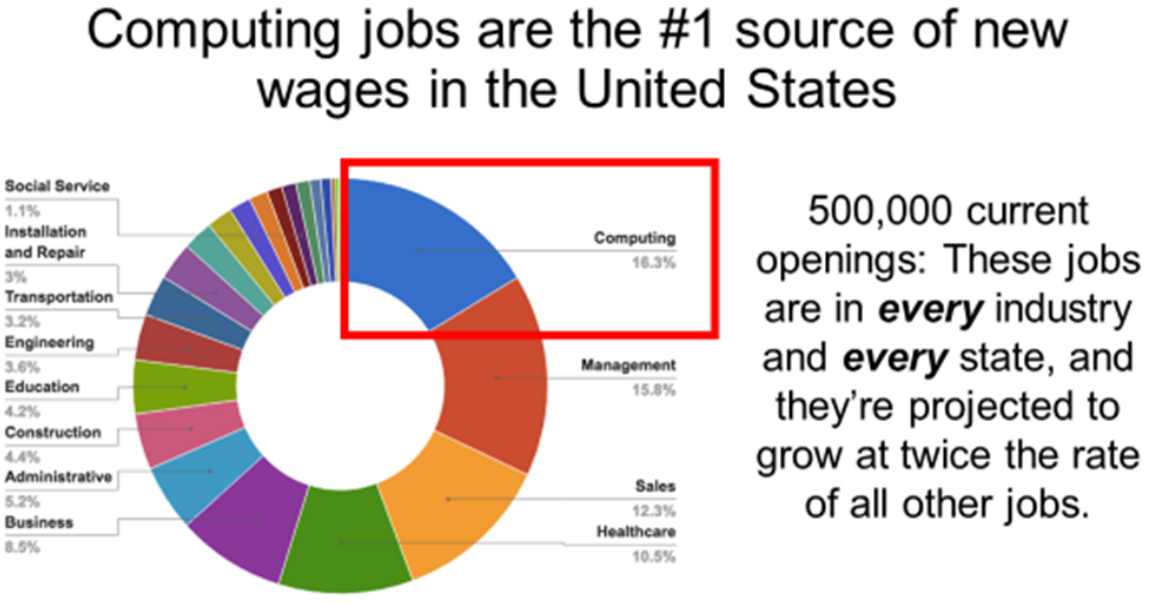
Introduction

Computer Science is at the forefront of innovation throughout the U.S. and global economy, but it remains marginalized throughout K-12 education. According to Cheng (2016), "Teaching math with computer programming – either as part of a standard math course or as an elective – can give mathematical concepts context and relevance while still requiring the same amount of rigor as traditional mathematics instruction." How awesome would it be to combine math and computer science as a means of helping students understand abstract mathematical concepts and learning computer coding? This is definitely a win-win scenario!

So, what is Code Studio? Code Studio is a fun, creative platform for learning basic coding and computer science. Using a blended learning model, students will be learning with a mix of online activities (on the computer) and "unplugged" classroom activities that use no computer at all. Being an educator in this technological era means staying up to date with engaging programs that will help students not only understand complex and abstract concepts, but allow them to see how those concepts are useful in preparing them for their possible future careers.

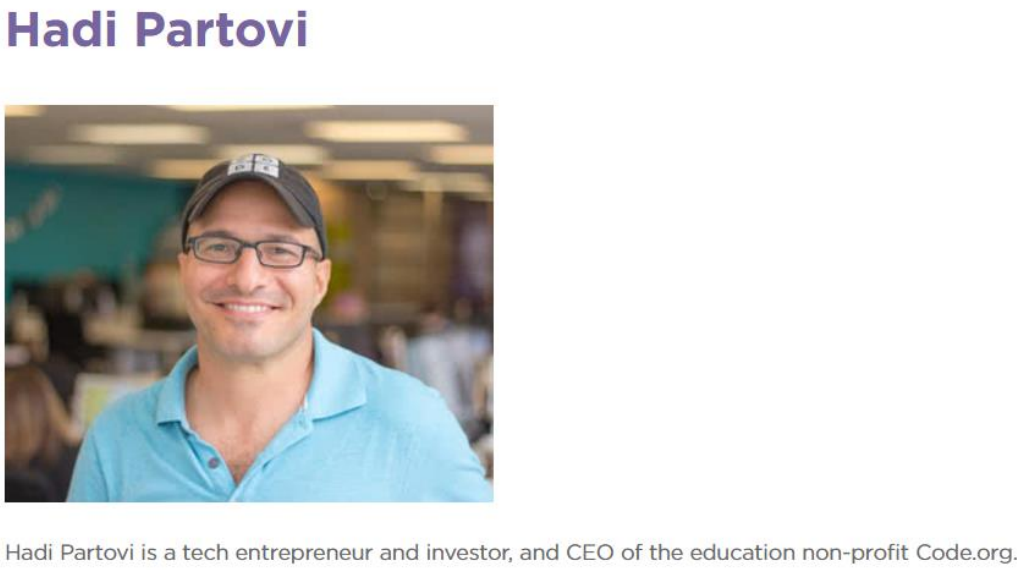
Course Outline and Overview

Computer science is becoming an essential part of our lives. According to Crow (2014) “It is the language of our world. In the future, not knowing the language of computers will be as challenging as being illiterate or innumerate are today.” This is why combining math and computer science makes so much sense. These are not conventional times as when we went to school. The math hasn’t changed but the way in which we teach it must if we are to prepare our students for the challenges of the real world and future careers. Today’s students are more tech savvy than we ever were. They have grown up during the technological era where the internet is their means of entertainment, education, and problem solving. How many times have you asked a young person a question which they do not know and they say, “just Google it!” Back in our days we had encyclopedias and the library. That was it! Students now a days need much more stimulation and motivation to learn. What better way to learn abstract math concepts than playing a game where they have to solve a problem by using computer science with graphics.

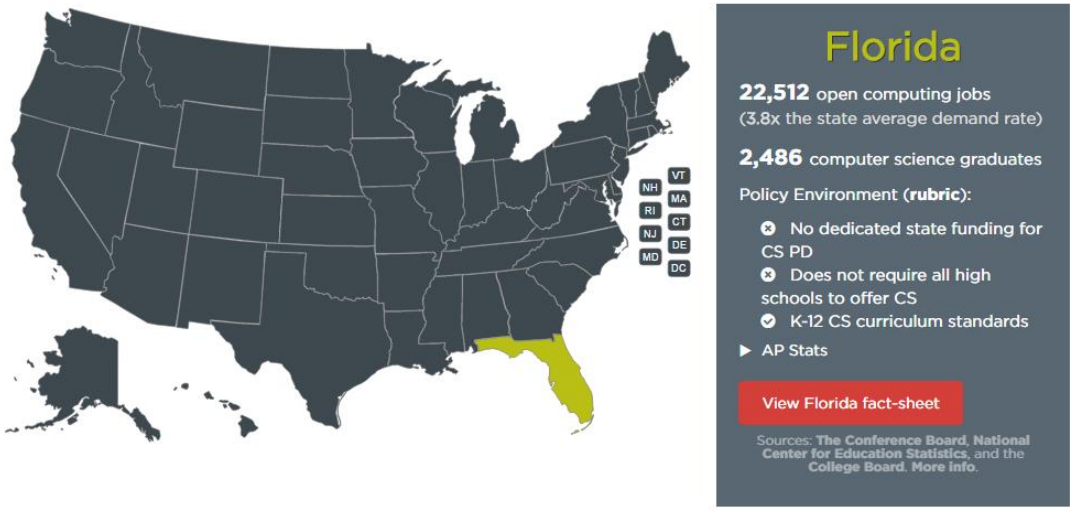


Source: Code.org (2017)

Code.org is a free non-profit organization who believes that every student should have the opportunity to learn computer science. The website is led by Hadi Partovi (Code.org 2017).



According to Code.org (2017), Computer Science Fundamentals is intended mainly for an elementary school audience, yet students of all ages will find it will help their problem-solving skills. Critical thinking, logic, persistence, and creativity help students excel at problem-solving in all subject areas, no matter what their age.



To begin this computer science initiative the first step is to create a free account. Once on their web-site, select the Sign in icon on the top right part of the page. When asked which type of account to create, select “Teacher”. The site allows browsing of various puzzles and stages even without an account, but progress and projects cannot be saved unless the account is created. To feel comfortable with teaching coding some basic training is needed, therefore I suggest completing the Hour of Code online.

The Hour of Code started as a one-hour introduction to computer science, designed to demystify "code", to show that anybody can learn the basics, and to widen participation in the field of computer science. It has since become a worldwide effort to celebrate computer science, starting with 1-hour coding activities but expanding to all sorts of community efforts (Code.org, 2017). Not completing this introduction in one hour should not lead to discouragement; what is important is to be able to grasp the concept and goal of each activity puzzle regardless of how long it may take to complete.

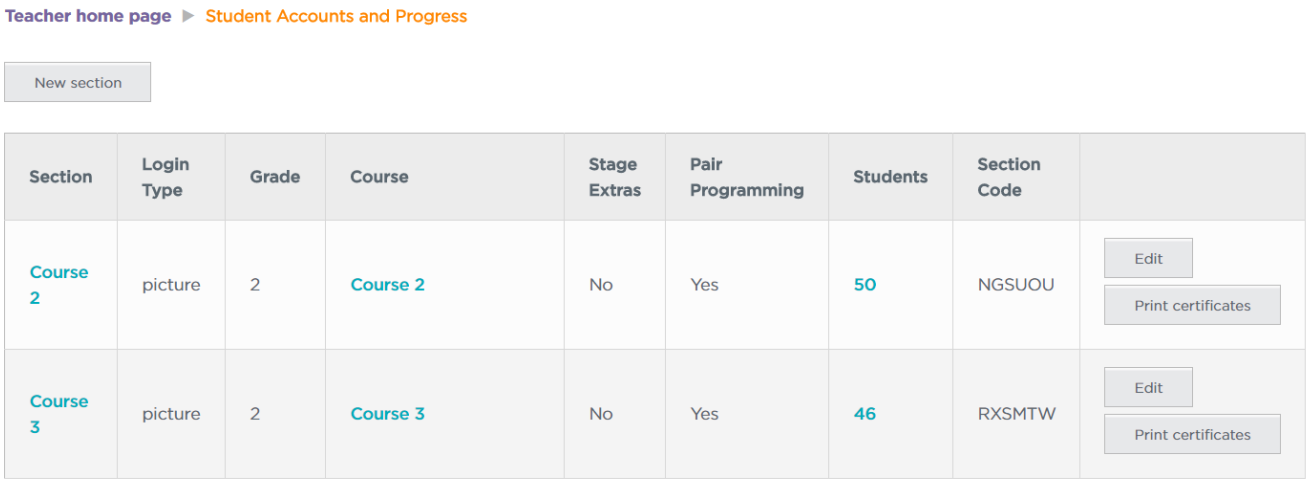
Face-to-face classes are also available by signing up through the M-DCPS My Learning Plan or through Code.org. The course is called Code.org K-5 Computer Science Curriculum. Classes are usually held on Saturdays in the Microsoft Store in Dadeland Mall. This course focuses on the benefit of starting coding early. The course will demonstrate an engaging curriculum that will allow students to explore the infinite world of technology, beginning as early as Kindergarten in elementary school. I highly recommend that every teacher take this course as it will introduce the participant to coding with no previous coding knowledge.

Once completed, the Hour of Code and the Code.org Computer Science Curriculum class will equip teachers with the basic knowledge necessary to start setting up their students. The diagram below depicts what course is designed for each grade level. I recommend starting students on Course 2 (also called Course B) so they can get a feel of what coding is all about from a foundational point of view. In other

words, whether students are 1st or 5th graders, they should begin with Course B (or 2).

Course A	Course B	Course C	Course D	Course E	Course F
Designed for Kindergarten	*Designed for 1st grade*	*Designed for 2nd grade*	*Designed for 3rd grade*	*Designed for 4th grade*	*Designed for 5th grade*

The Code Studio teacher home page makes it easy for teachers to view lesson plans, create student accounts and monitor student progress. Students don't need an email address to have an account in Code Studio. Students can even log in with a picture instead of a text password. Using a picture as their password will ensure younger students can login easily. On my classroom computers, I created a shortcut on the desktop of the school's student account, so students could just click on it then select their password image. Believe it or not just simplifying the access to computer programs gives students a sense of independence and boosts their self-esteem knowing they can do it on their own.

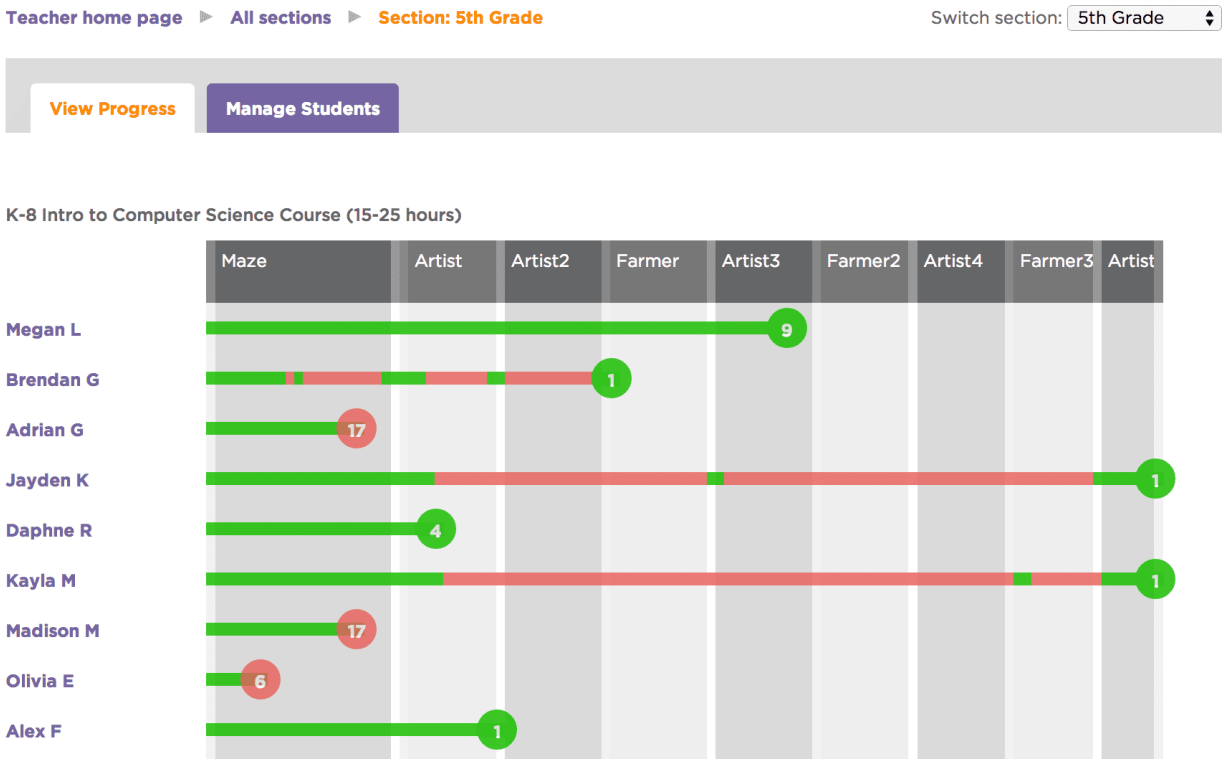


Login Type

This table helps explain which of these login types, **picture, word, or email**, you'll want to choose for a section.

	Picture	Word	Email
Do all students have a valid email address?	No	No	Yes
Who creates the student's account?	Teacher	Teacher	Student
What do students use as a "password"?	A picture assigned by Code.org	A pair of simple words assigned by Code.org	Student-created text password
Where do students sign-in?	Unique web-page listed on "Manage Students" tab	Unique web-page listed on "Manage Students" tab	http://code.org and click "Sign in"

Teachers can easily track student progress and see where they are having difficulties. Once the student has successfully mastered all levels of their current course they are ready to move onto the next course. I made sure to check my Teacher Home Page and "View Progress" tab in order to ensure they have completed all levels perfectly before moving on to the next course.



Sample Lesson

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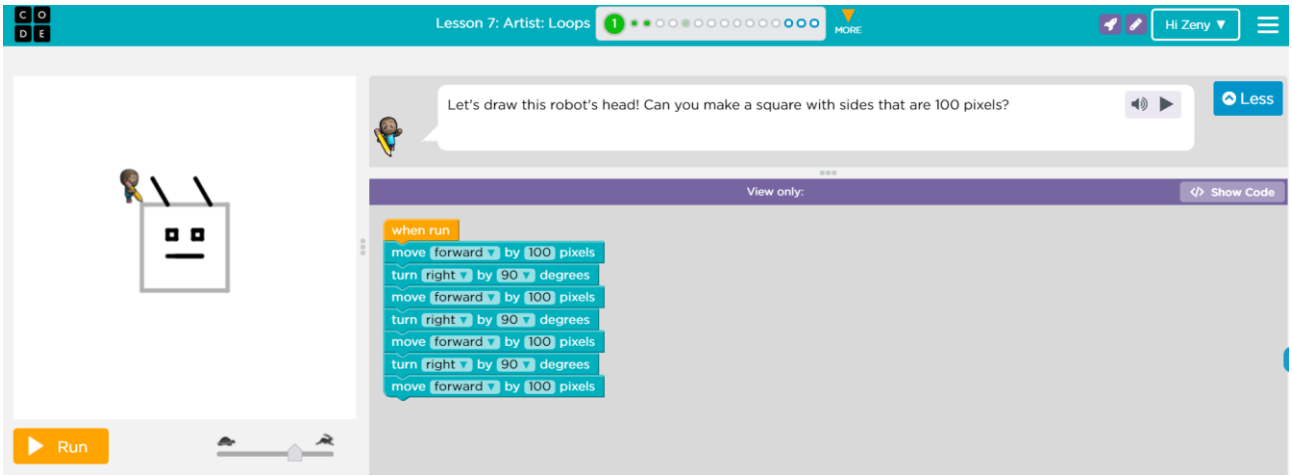
Course 2 | Lesson 7

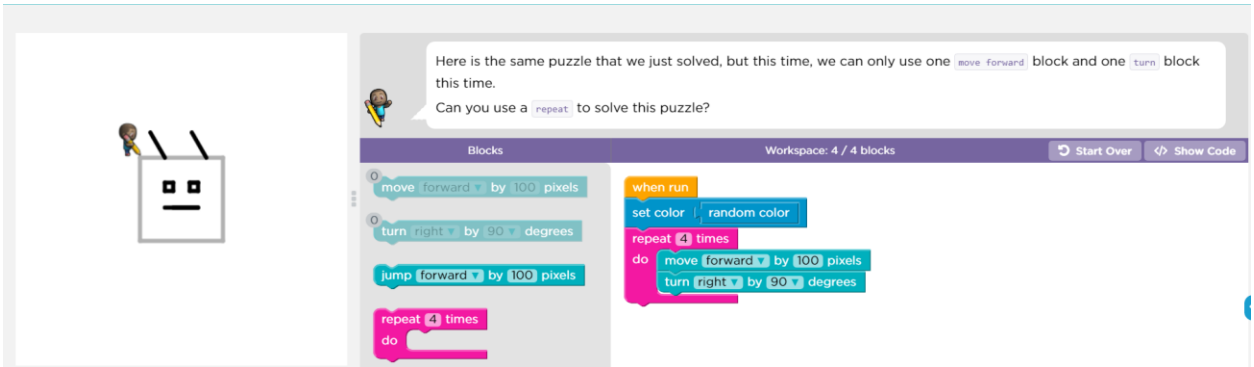
Artist: Loops

In this introductory studio art lesson students must learn to draw the robot's head using right angles or 90˚and 100-pixel lengths. After solving the lesson students might realize that the pattern of making right angles and going forward by 100 pixels can be simplified by simply writing it once and then inserting the repeat block 4 times.

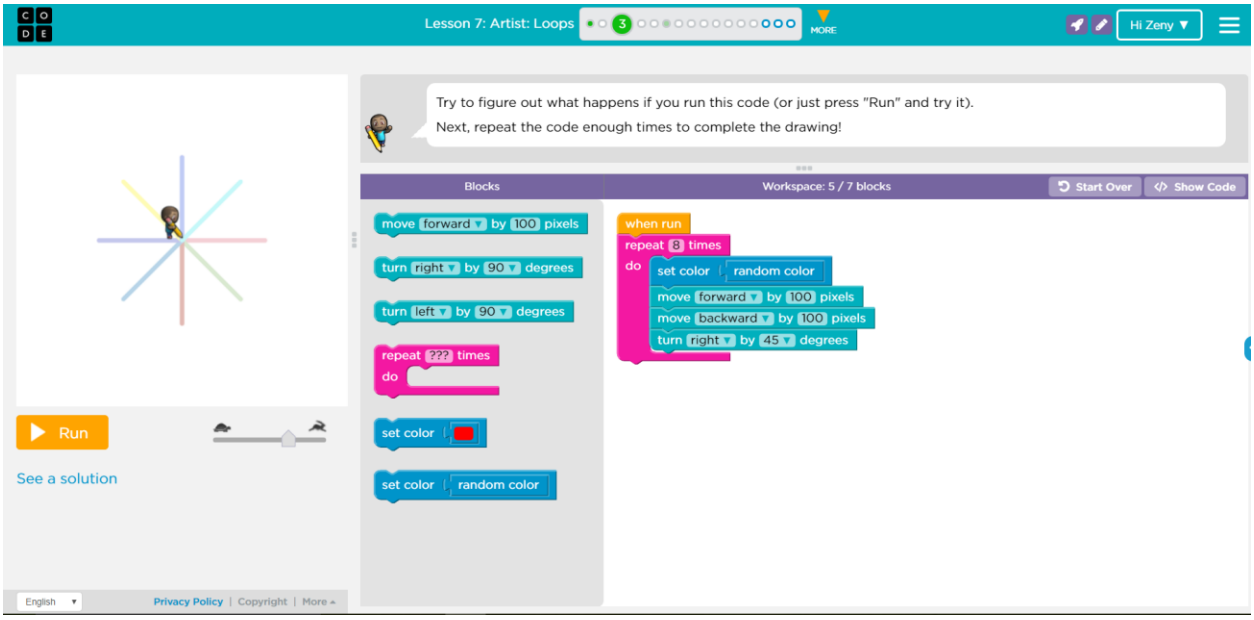


Students just learned how to draw a right (90˚) angle four times to create a perfect square figure. After doing the same thing 4 times they might start wondering how to simplify the process by having a repeat block. Watch how repeating patters can easily be produced with the repeat block:

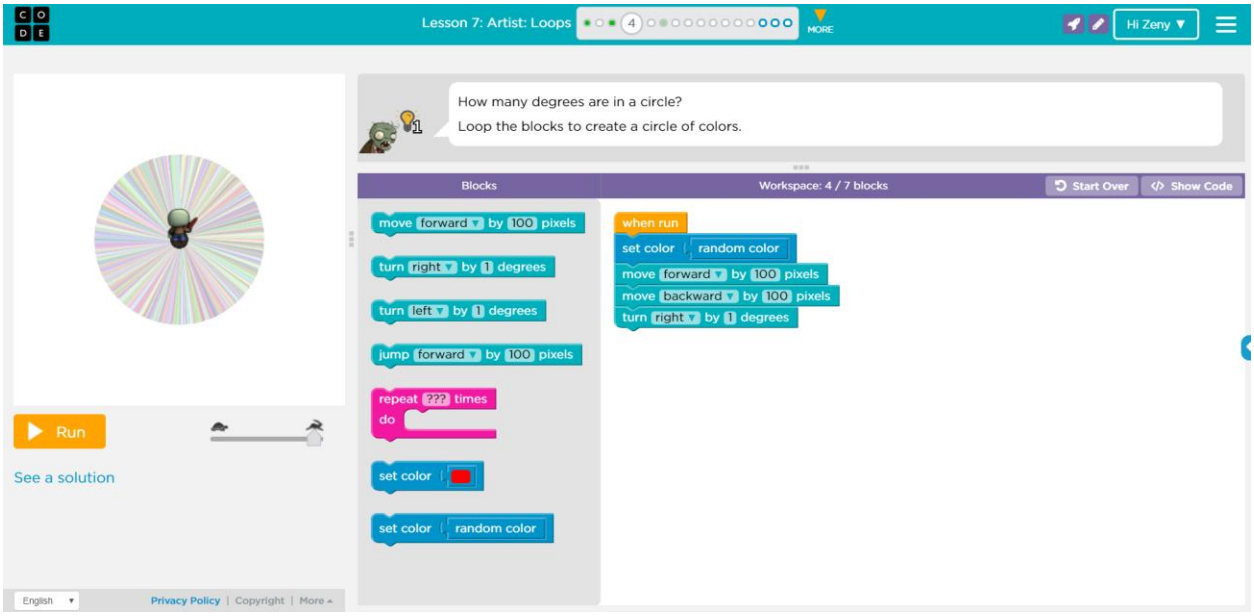
https://studio.code.org/s/course2/stage/7/puzzle/2



Now students learned how using a short-cut block called “repeat” can simplify their actions to attain the same goal. Next, we will take a look at lesson 3 within the Lesson 7: Artist Loops. Here students have to draw the shape below. They must figure out that if they use again the 90 degrees block they are only completing half the image. So, after trial and error they understand that they must divide the 90 degree angle into two or 45 degrees to accomplish the shape below. Again, they use the repeat block since this time they have twice as many repeating patterns to draw the image.



Lesson 4 within the Artist Loops asks to draw a complete circle with a 1-degree block. Here they get to realize that a full circle is 360 degrees and if you divide 360 into 1, you must use the repeat block 360 times to draw a complete circle image.



Sample Unplugged Lesson

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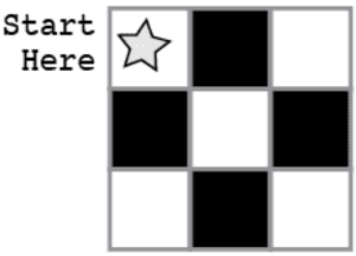
UNPLUGGED

Graph Paper Programming

Unplugged activities will introduce computer science concepts using physical manipulatives before students write computer programs using those concepts without the use of a computer. For example, getting to fill-in the squares below requires a general knowledge of getting from point A to point B.

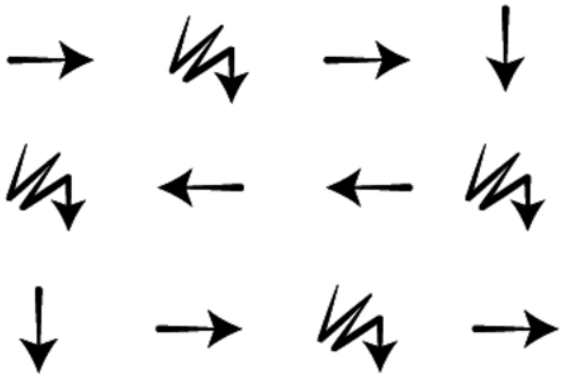
Start your class off in the world of programming by drawing or projecting the provided key onto the board.

Select a simple drawing, such as this one to use as an example.

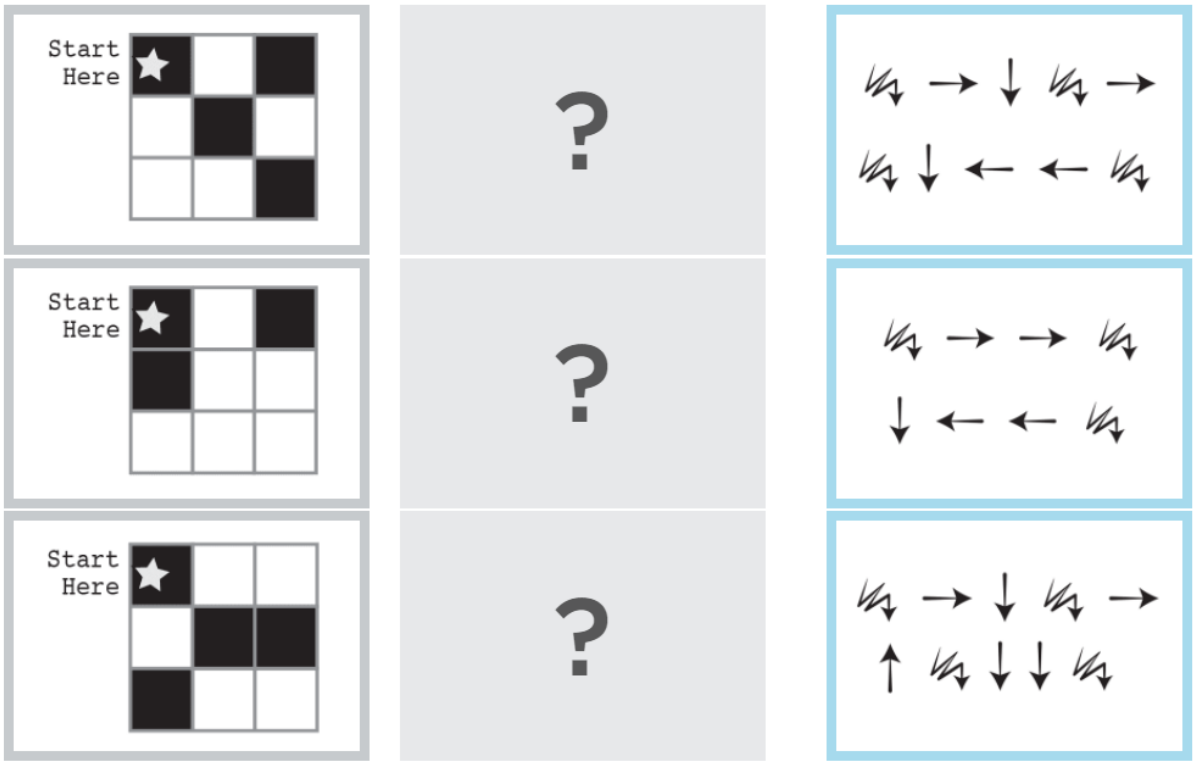


A sample algorithm:

"Move Right, Fill-In Square, Move Right, Move Down
Fill-In Square, Move Left, Move Left, Fill-In Square
Move Down, Move Right, Fill-In Square, Move Right"



Match the grid to the program.



This type of unplugged activity will help students write an algorithm (a set of instructions) using a set of predefined commands to direct their classmates to reproduce a drawing. Before you know it they are able to recognize and produce algorithms which is the fundamental language of computer science.

Learning to Code Internet Resource Sites:

Code.org: https://code.org/

Khan Academy: https://www.khanacademy.org

Tynker: https://www.tynker.com/

Code Academy: https://www.codecademy.com/

Codewars: https://www.codewars.com/

Code Avengers: https://www.codeavengers.com/

Code Combat: https://codecombat.com/

Scratch: https://scratch.mit.edu/

Hackety Hack: http://www.hackety.com/

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- Quick and easy reporting requirements
- Grants range from $150 - $400
- Grant recipients recognized at an Awards Reception

To apply, you must contact the teacher who developed the idea before submitting your application. Contact can be made by attending a workshop given by the disseminator, communicating via email or telephone, by visiting the disseminator in their classroom, or by having the disseminator visit your classroom.

Project funds are to be spent within the current school year or an extension may be requested. An expense report with receipts is required by Friday, June 1, 2018.

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