



Human Coding

Adapted from Coding Without Computers – DiscoverE.org

https://www.discovere.org/sites/default/files/Coding%20Without%20Computers_2page_C.PDF

Objectives

Students will:

- Write a program that a human “robot” will follow to complete a task.
- Communicate with written rather than verbal directions.
- Learn how computer engineers use symbols to code.
- Learn how to “debug” or improve upon an initial code or plan.

Suggested Grade Level

4th - 12th

Subject Areas

Coding, technology

Timeline

45 Minutes

Standards

NGSS Standards

- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

21st Century Essential Skills

- **Learning Skills**
 - Critical Thinking, Analysis, Collaboration, Communication

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- **Literacy Skills**
 - Information, Technology
- **Life Skills**
 - Leadership, Initiative, Productivity, Listening

Background

Computer programming has increasingly become a sought-after career in the 21st century. It is the process of designing and building tasks for a computer to follow. The language a computer follows is called coding. Each code is a symbol that represents a specific action. A programmer will use code to write a sequence of instructions that will automate the performance of that specific task. Common tasks are testing, debugging, building and managing computer programs. These actions lead to software development and engineering.

Vocabulary

Coding, programming, symbols

Materials

- 6 - 10 plastic cups per group
- Paper
- Pencil

Lesson

1. Write a programming symbol key on the board (see figure One) prior to starting the lesson.
2. Ask students, "What is programming? What is coding?" Distinguish the difference between programming and coding.
3. Read this quote to students, "Seven million job openings in 2015 were in occupations that required coding skills, and programming jobs overall are growing 12% faster than the market average." Ask students, "What does this mean for you?"
4. Ask students to describe how robots (or computers) know what to do. Focus the discussion on how they are programmed, or coded, to follow step-by-step directions.
5. Explain to students they will be writing a code using the 6 arrow symbols. When the program is written, have a human "robot" read that code to build that structure.
6. Split the class into teams of 3 or 4. Each team will choose a "robot" and the remaining students are the programmers. Send the robots to the "Charging Area"

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while the rest of the team writes the program. Robots can use their time to make sure they understand the rules.

7. Display the structure the robot must build (see figure Two). Using the symbols, programmers need to work together to write the code out in the most efficient way (fewest number of commands) to get the robot to create the pyramid. Remove the image of the structure before robots come back to the testing area.
8. Have robots return to the test area and “run the program.” The programmers are not allowed to talk or use gestures to the robot at all; they may only WATCH and observe where their robot made errors. The robot must follow the code exactly as written. If the group notices a mistake, they must halt the program, send the robot back to the waiting area, and fix the mistake before bringing the robot back.
9. Compare their programs when all the groups are done in order to see how many steps each one used.
10. Build a higher pyramid or design a new pattern with the cups, and then repeat the process when each team chooses a new robot.

Extensions

1. Time groups on how fast they can build the cup design.
2. Update the computer program. Write new codes for your human robot, and put images on the cups to test for accuracy.
3. Introduce “Folding for Launch: Origami in Space” lesson. Incorporate how folding origami is like coding, where you must be detailed in your “program” or directions. If you don’t write the instructions correctly or type precise programming codes, you will not be able to create an object or perform a task.
4. Visit <http://www.discoverspace.org/> for more innovative ideas and resources.

Resources

Coding Without Computers. (n.d.). Retrieved August 26, 2020, from https://www.discovere.org/sites/default/files/Coding Without Computers_2page_C.PDF

Dishman, L. (2016, June 14). Why Coding Is Still The Most Important Job Skill Of The Future. Retrieved August 26, 2020, from <https://www.fastcompany.com/3060883/why-coding-is-the-job-skill-of-the-future-for-everyone>

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- ↑ — Pick Up Cup
- ↓ — Put Down Cup
- — Move 1/2 Cup Width Right
- ← — Move 1/2 Cup Width Left
- ↻ — Rotate Cup 90° Clockwise
- ↺ — Rotate Cup 90° Counterclockwise

Figure One: Symbols for coding your robot



Figure Two: Structure for your first build