

Code.org's Mission To Enable Every School To Teach Computer Science

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Abstract

Code.org has the vision that "every student in every school has the opportunity to learn computer science, just like biology, chemistry, or algebra.". In a 2019 interview with the New York Times, the founder of code.org, Hadi Partavi said "In the 21st century, computer science is as important as biology." ... "We're not trying to prepare kids for jobs. We're trying to prepare kids for life." (Gelles, 2019) In my research, code.org has been consistently executing this vision for over a decade since its founding in 2013.

Code.org's website claims that 90% of parents want their child to study computer science but only 53% of high schools offer computer science. Over 50 million students and 1 million teachers have signed up on code.org to participate in their annual hour of code program or one of their computer science classes. 45% are female students, 50% are under-represented racial/ethnic groups and 45% are students in high-needs schools. (Code.org, 2023). In a 2020 Gallup poll, "about seven in 10 parents and guardians of U.S. students in grades seven through

12 (69%) say it is important or very important for their child to learn computer science."
(Calderon & Marken, 2020)

I have found ample evidence that Code.org has provided a learning platform to bring computer science into the classroom of every single school in the world from K to 12. The learning materials are translated into more than 60 languages. (*Language Support for Each Tutorial*, n.d.) In this paper, I will demonstrate how a teacher without a computer science degree can leverage free lesson plans, free video libraries, and classroom management tools to engage their students to learn the fundamentals of computer science.

What is code.org?

Code.org offers free courses for grades K-12 students as self-paced or taught by teachers in classrooms. It also provides a teacher portal, a full teaching curriculum, slides, and speaker's notes to empower any teacher to be able to teach computer science to their students. They do require each teacher to go through a four-hour self-paced training and also to be verified through their school before the teacher can get access to the answer key to do assessments of the students.

Code.org's terms of service are easy to understand and clearly state that their videos, curriculum, and tutorials are licensed under Creative Commons Attribution-NonCommercial-ShareAlike 4.0 which "grants you a non-exclusive, transferable, non-sublicensable, limited right and license to access, view, use, and display the Code.org curriculum and tutorial materials." (*Terms of Service*, 2022). I also reviewed their tax return as a 503 non-profit to reassure myself that Code.org is operating as a public good entity.

In this paper, I will give an overview of the courses offered by Code.org for K-12 and go deeper into how I set up a course for 6th to 9th graders as a teacher in their administrative portal.

In future papers for the ITEC 830 class, I will further investigate code.org as an instructional tool for other age groups.


Courses Offer By Code.org for K-12

For students K-5, Code.org offer age-appropriate lesson plans that are sequenced and clearly scoped. These lessons are either concepts, online activities, or unplugged activities. The software is called Studio Code and is very similar to MIT Scratch but with less freedom and thereby more predictable. Figure A shows the courses available to K-5 students.

Courses by Code.org

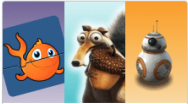
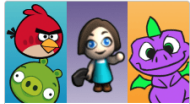
Computer Science Fundamentals Express Courses

A great option for students getting started on their own. You'll learn the fundamentals of computer science with drag & drop blocks. Create your own drawings and games.

Pre-reader Express An introduction to computer science for pre-readers: combines the best of our kindergarten and first grade courses. Ages: 4-8	 Express Course An introduction to computer science: combines the best of our elementary school curriculum for older students. Ages: 9-18
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Computer Science Fundamentals for Elementary Schools

For pre-readers in elementary school classrooms

 Course A Ages 4-7 An introduction to computer science for pre-readers.	 Course B Ages 5-8 An introduction to computer science for pre-readers. (Similar to Course A but with more variety for older students.)
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For older students in elementary school classrooms

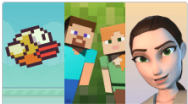



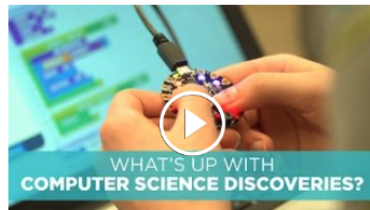
 Course C Ages 6-10 Learn the basics of computer science and create your own art, stories, and games.	 Course D Ages 7-11 Quickly cover concepts in Course C, then go further with algorithms, nested loops, conditionals and more.	 Course E Ages 8-12 Quickly cover concepts in Course C & D and then go further with functions.	 Course F Ages 9-13 Learn all the concepts in Computer Science Fundamentals and create your own art, story or game.
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Figure A: A list of courses for K-5 students

For grades 6-12, there are a set of self-paced classes, along with lessons that can be taught in classrooms for multiple semesters and prepares students for the Computer Science AP exams. This is where code.org really shines because they meet the CSTA (Computer Science Teachers Associate) standards. See Figure B

Learning in the classroom

Computer Science Discoveries



CS Discoveries is an introductory course for 6-10th grade students that can be flexibly taught as a single semester, two semesters over multiple years, or as a full year course. Mapped to CSTA standards, the course takes a wide lens on computer science by covering topics such as problem solving, programming, physical computing, user-centered design, and data, artificial intelligence, and machine learning, while inspiring students as they build their own websites, apps, games, and physical computing devices.

[Learn about CS Discoveries](#)

[Learn about professional learning](#)

Computer Science Principles (intro and AP course)



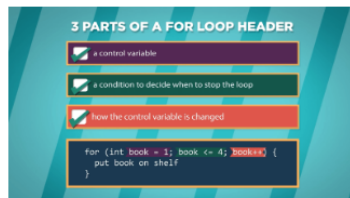
Designed for 9 - 12 grade students, CS Principles introduces students to the foundational concepts of computer science and challenges them to explore how computing and technology can impact the world. This year-long course can be taught as an introductory course and as an AP course - no prerequisites required for students or teachers new to computer science! CS Principles complements CS Discoveries with a deeper focus on concepts such as how the internet works and the societal impacts of computer science.

[Learn about CS Principles](#)

[Learn about professional learning](#)

Students who take AP Computer Science Principles are **12% more likely to enroll in college** compared to similarly-situated peers, and students who take AP exams are **more likely to graduate 4-year college**, regardless of their score on the exam. AP computer science students also earn **better AP Calculus scores** than comparable students who don't take AP computer science.

Computer Science A



Computer Science A (CSA) introduces students to software engineering and object-oriented design while learning the Java programming language. The Code.org CSA curriculum is recommended for any high school student who wants to continue their computer science education after completing an introductory course, such as CS Principles or CS Discoveries. Students expand their programming skills by developing solutions in the Java programming language, building on the knowledge they acquired from their previous introductory computer science course.

[Learn about CSA](#)

[Learn about professional learning](#)

Figure B: Classroom courses for grades 6 to 12

Each course is divided into small bites of content that are directed, and specific and build up the knowledge gradually. In Figure C, the student is in Lesson 5, learning how to fix an existing problem. In my professional experience as a software engineer, debugging and troubleshooting are close to 80% of the time and effort.

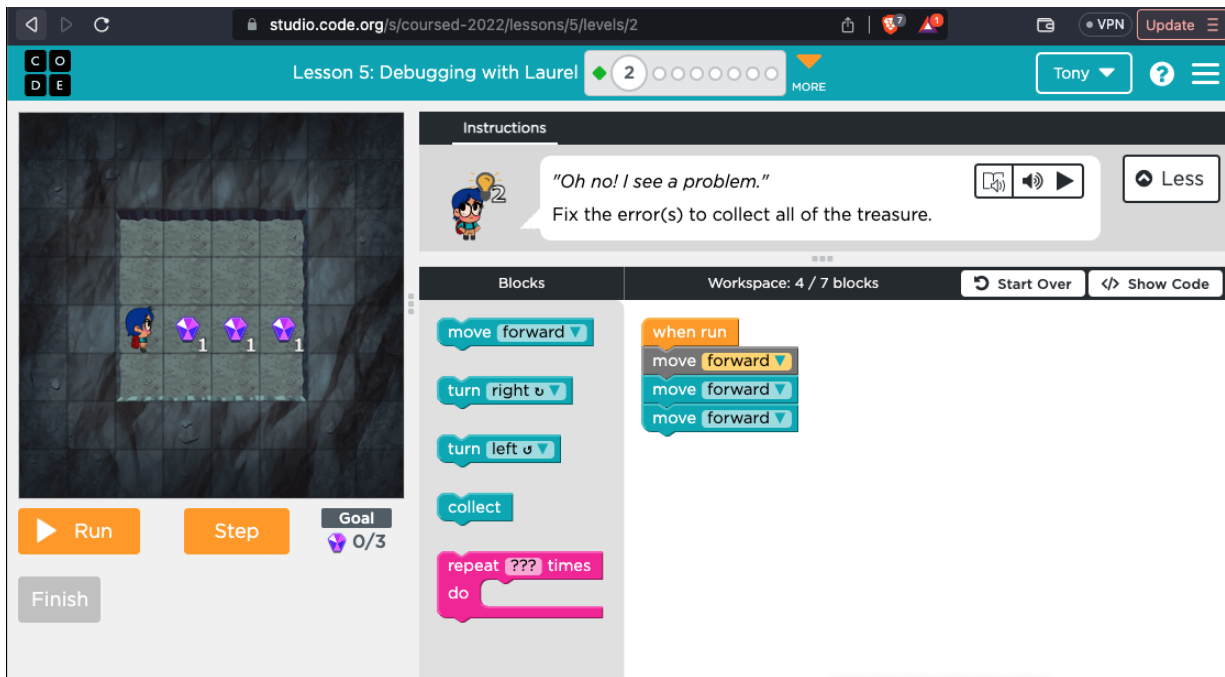


Figure C: A lesson on fixing something that is broken

In contrast to other platforms where students have a lot more freedom to experiment and get lost, in Code.org students can only use a subset of commands in each step of the lesson which doesn't distract them and helps them learn what is needed in this particular step of the larger lesson. In Figure D, the student is encouraged to read the existing coding block to understand what the code is doing. In this case, the bird should turn around, and "B: Make it to the pig". The student can interactively see whether their answer is correct. Reading other people's code is a large part of a professional software developer's job.

Lesson 3: Programming with Angry Birds

Instructions

Read through the code below very carefully. What will happen when you click "Run"?

- A. The bird will end up one step short of the pig.
- B. The bird will make it to the pig.
- C. The bird will run into the TNT.
- D. The bird will run into the wall.

View only: 8 / 8 blocks

Show Code

```

when run
  turn left
  turn left
  move forward
  turn left
  move forward
  move forward
  move forward
  
```

Run Step

Figure D: Students are encouraged to read existing code

Teaching A Course with code.org

Teachers who are verified have access to student assessment and surveys, example solutions and answer keys, the ability to remove abusive projects from their product gallery and the ability to leave feedback for students and access to teaching tips. You can become a verified teacher by attending a professional development course or be manually verified as a teacher by filling out a form and being verified by a school's administrator or appearing as a faculty member on a school's website. (*How to Become a Verified Teacher – Code.org, 2023*)

Once verified, you have to take a four-hour self-paced class to learn how to teach CS Principles. (*Code.org Teaching CS Principles, n.d.*) where you learn how to navigate the Code.org teaching portal and learn about an overview of the CS Principles course.

As a teacher, you can start a customized course by creating multiple sections using the existing teaching materials. For example, I built out a course for 9th graders that will span an entire semester by using all 6 units of their existing program Computer Science Discoveries. Unit 1 is Problem Solving and Computing, Unit 2 is Web Development, Unit 3 is Interactive Animations and Games, Unit 4 is The Design Process, Unit 5 is Data and Society, Unit 6 is Physical Computing and the last bonus section is AI and Machine Learning. Figure E shows 2 chapters of Unit 1: Problem Solving and Computing.

Unit 1 - Problem Solving and Computing ('22-'23)

Problem Solving and Computing is a highly interactive and collaborative introduction to the field of computer science, as framed within the broader pursuit of solving problems. You'll practice using a problem solving process to address a series of puzzles, challenges, and real world scenarios. Next, you'll learn how computers input, output, store, and process information to help humans solve problems. The unit concludes with a project in which you design an application that helps solve a problem of your choosing.

Implementation Guidance for Problem Solving and Computing

- The first chapter of this unit should be completed before any other unit in CS Discoveries
- Alternate lessons are provided for some lessons in this unit, depending on your classroom context
- You can view the full [Curriculum Guide](#) and [Implementation Guide](#) for more information about this unit

▼ Teacher resources
▼ Printing Options
View calendar

Active section:

Computer Science - Problem Solving : ▼
+ Assign to sections
Show All Lessons
Hide All Lessons
?

▼ Survey

Lesson Name	Progress
CS Discoveries Pre-survey	

▼ Chapter 1: The Problem Solving Process ⓘ

Lesson Name	Progress
1. Intro to Problem Solving	This lesson contains no levels.
2. The Problem Solving Process	
3. Exploring Problem Solving	This lesson contains no levels.

▼ Chapter 2: Computers and Problem Solving ⓘ

Lesson Name	Progress
4. What is a Computer?	
5. Input and Output	
6. Processing	
7. Storage	
8. Project - Propose an App	
Post-Project Test	

Figure E: Teacher portal showing the course outline

For each course, I can invite students by giving them an invitation code and they will have to create a code.org login and enter the invitation code. For children under 13, they offer a privacy-friendly method where children can make up a 2-word password without the need for a password. For even younger children, they can click on 2 photos as their password.

Once a student starts to engage with the course material, as a teacher I have access to see the progress of each student on a dashboard. I can respond to text answers from the students, look at assessment data, and check the status of hands-on projects. Figure F shows a dashboard where the teacher can see a personalized view of the student's progress.

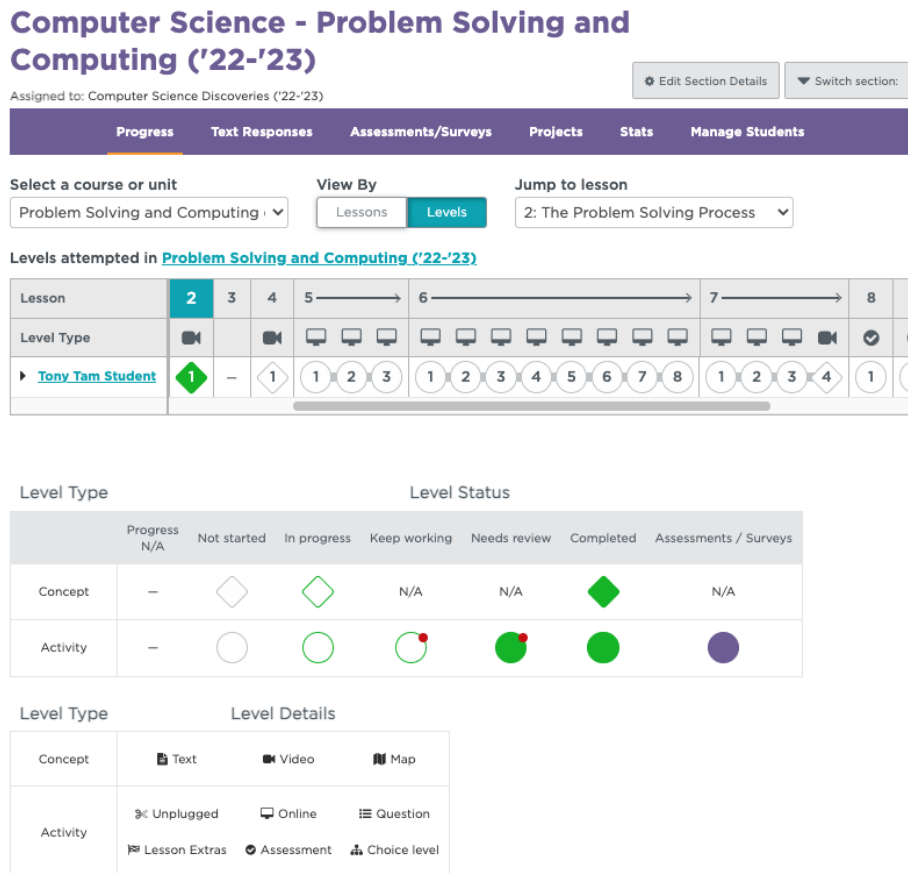


Figure F: Teacher portal showing student process

Conclusion

I have been amazed by the breadth of content available on Code.org for teachers with any level of background in computer science to start teaching computer science to their students. Teachers have access to 100% free lesson plans, activity guides, videos, tutorials, and curriculum to teach students from K to 12th grade. Teachers also are supported by a learning management system that can be used to see real-time stats on how each student is progressing. Code.org is the best platform I have seen so far to truly make computer science accessible to every school, every student, and every teacher.

References

- Calderon, V. J., & Marken, S. (2020, September 29). *Parents Think Computer Science Education Is Important*. Gallup News. Retrieved April 19, 2023, from <https://news.gallup.com/opinion/gallup/320354/parents-think-computer-science-education-important.aspx>
- Code.org. (2023, April 14). *Promote Computer Science*. Code.org. Retrieved April 14, 2023, from <https://code.org/promote>
- Code.org Teaching CS Principles*. (n.d.). Teaching CS Principles. Retrieved April 14, 2023, from https://studio.code.org/courses/self-paced-pl-csp-2022?section_id=4657817
- Gelles, D. (2019, January 17). *Hadi Partovi Was Raised in a Revolution. Today He Teaches Kids to Code. (Published 2019)*. The New York Times. Retrieved April 14, 2023, from <https://www.nytimes.com/2019/01/17/business/hadi-partovi-code-org-corner-office.html>
- How to Become a Verified Teacher – Code.org*. (2023, March 20). Code.org Support. Retrieved April 14, 2023, from <https://support.code.org/hc/en-us/articles/115001550131-How-to-Become-a-Verified-Teacher>
- Language support for each tutorial*. (n.d.). Code.org. Retrieved April 19, 2023, from <https://code.org/translate/supported>
- Terms of Service*. (2022, December 14). Code.org. Retrieved April 14, 2023, from <https://code.org/tos>