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 Partivi 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.

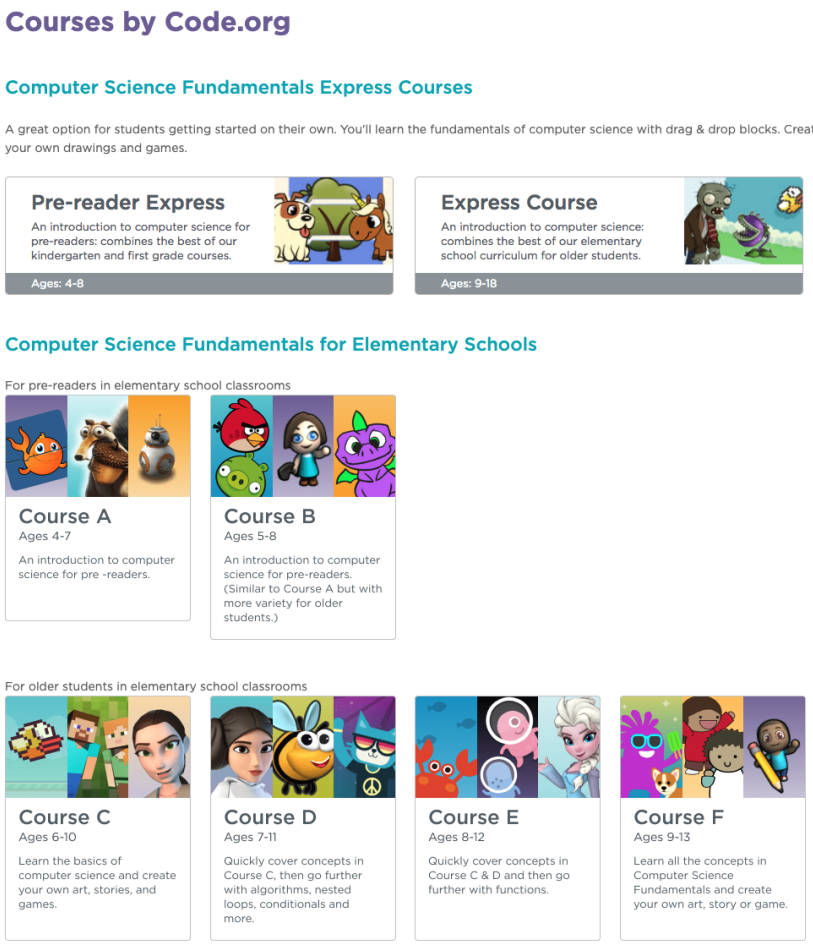

Figure A: A list of courses for K-5 students

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

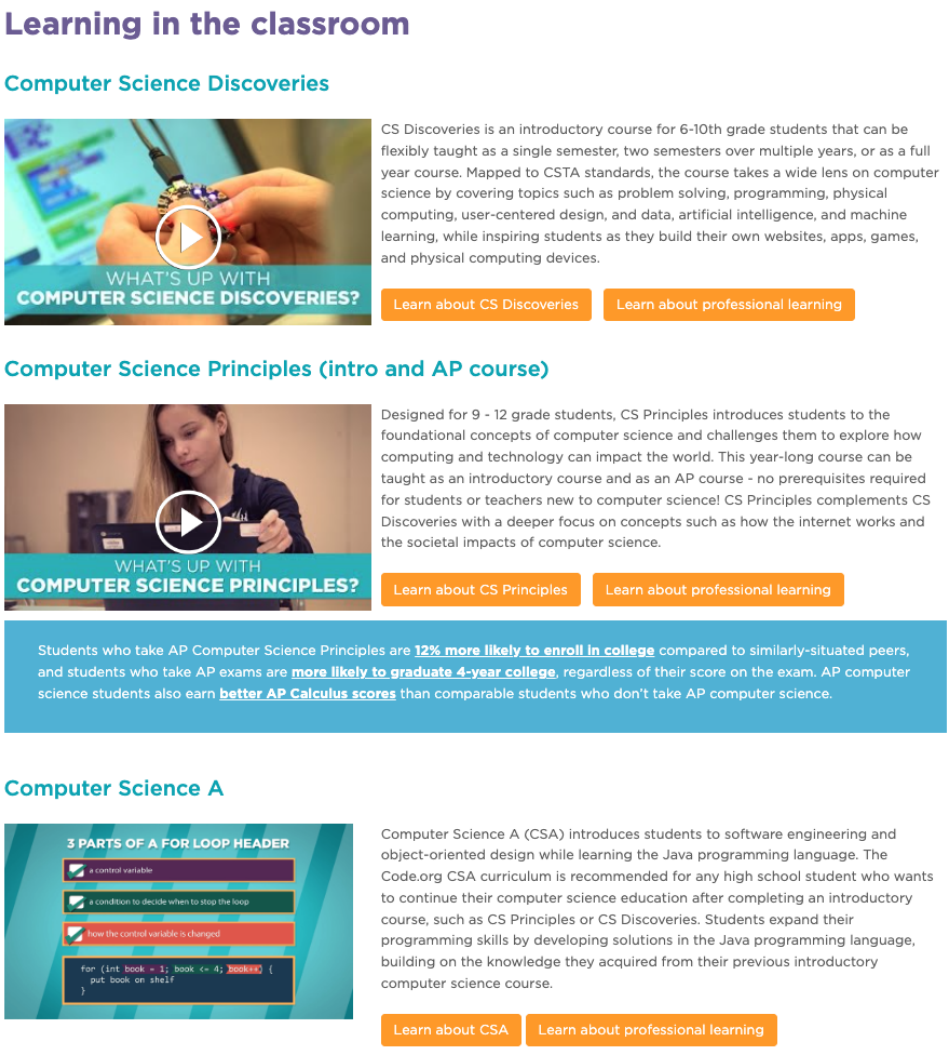

Figure B: Classroom courses for grades 6 to 12

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.

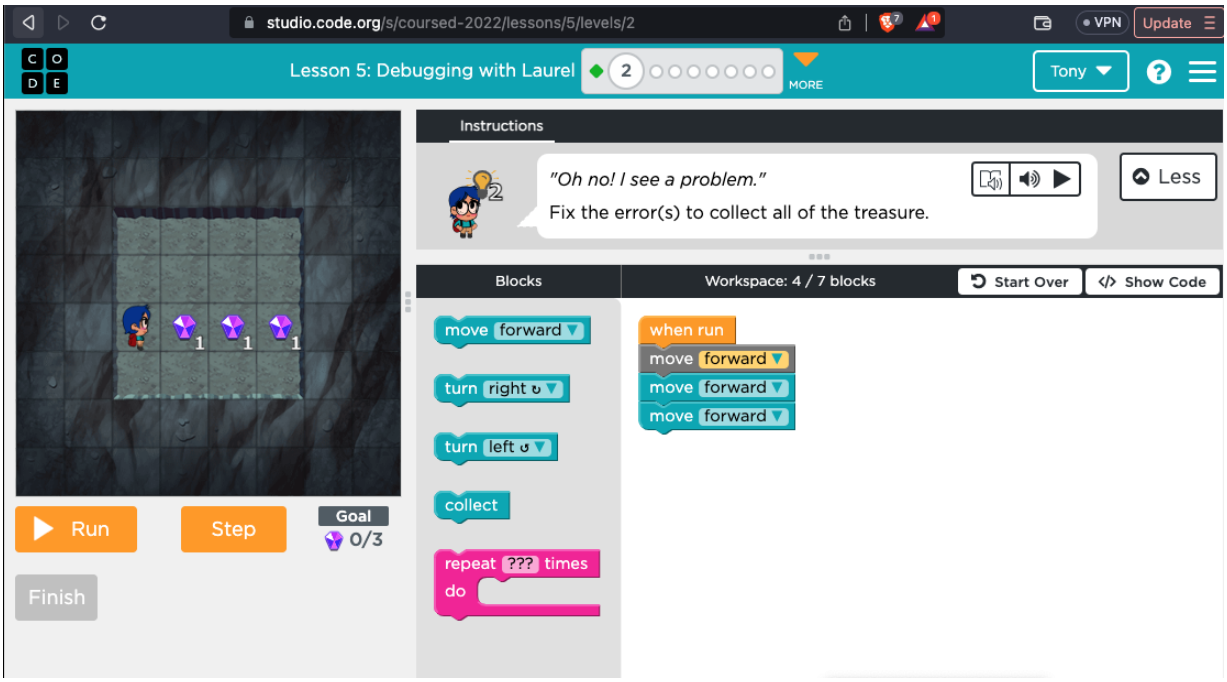

Figure C: A lesson on fixing something that is broken

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.

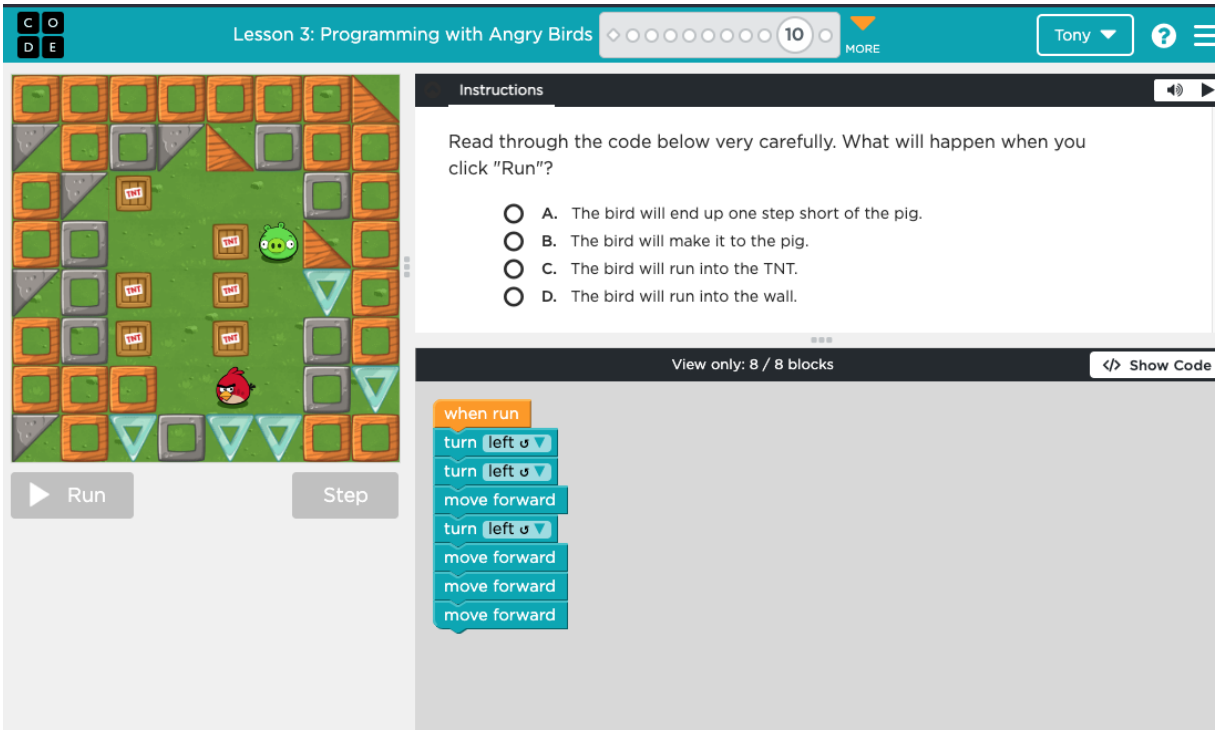

Figure D: Students are encouraged to read existing code

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.

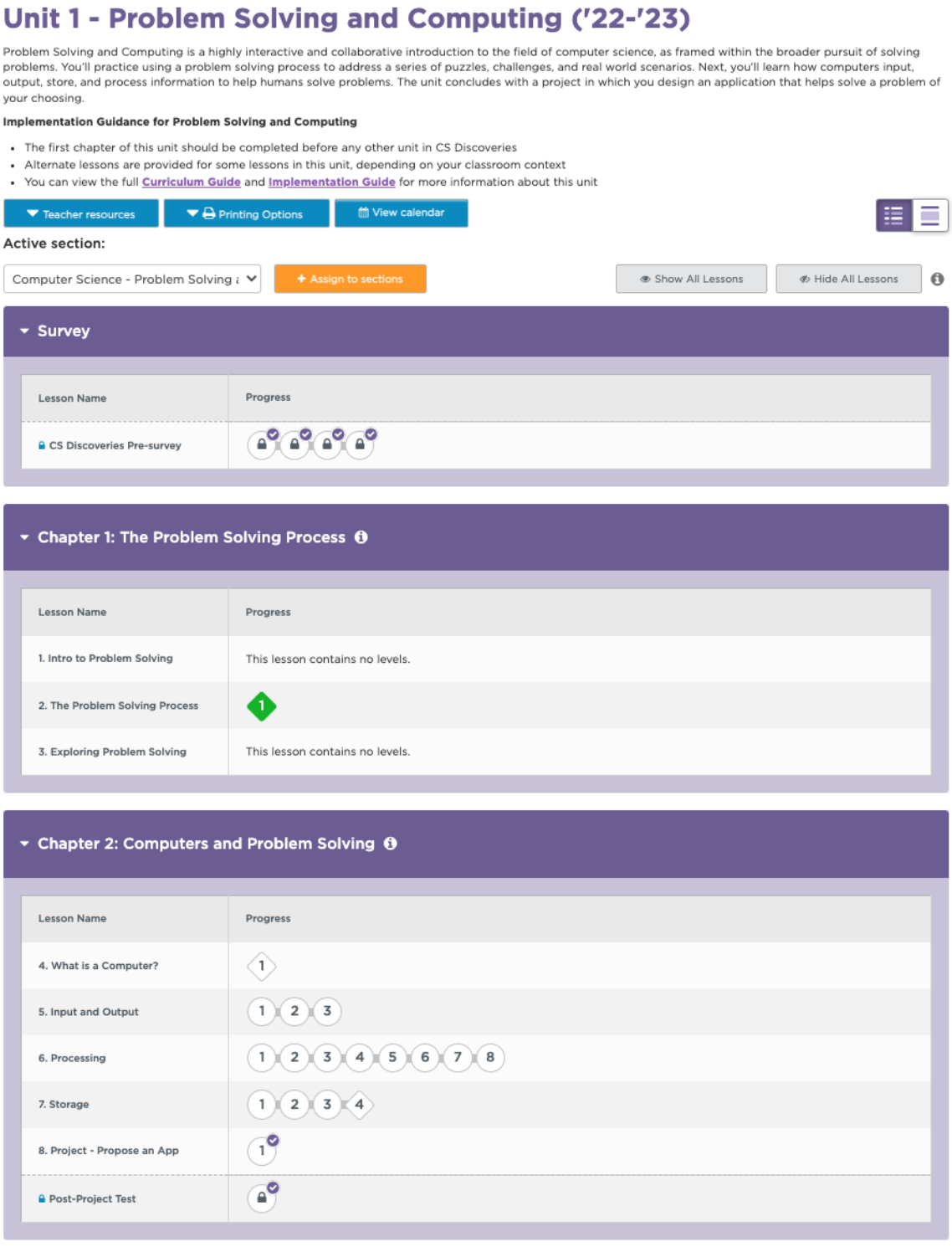

Figure E: Teacher portal showing the course outline

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.

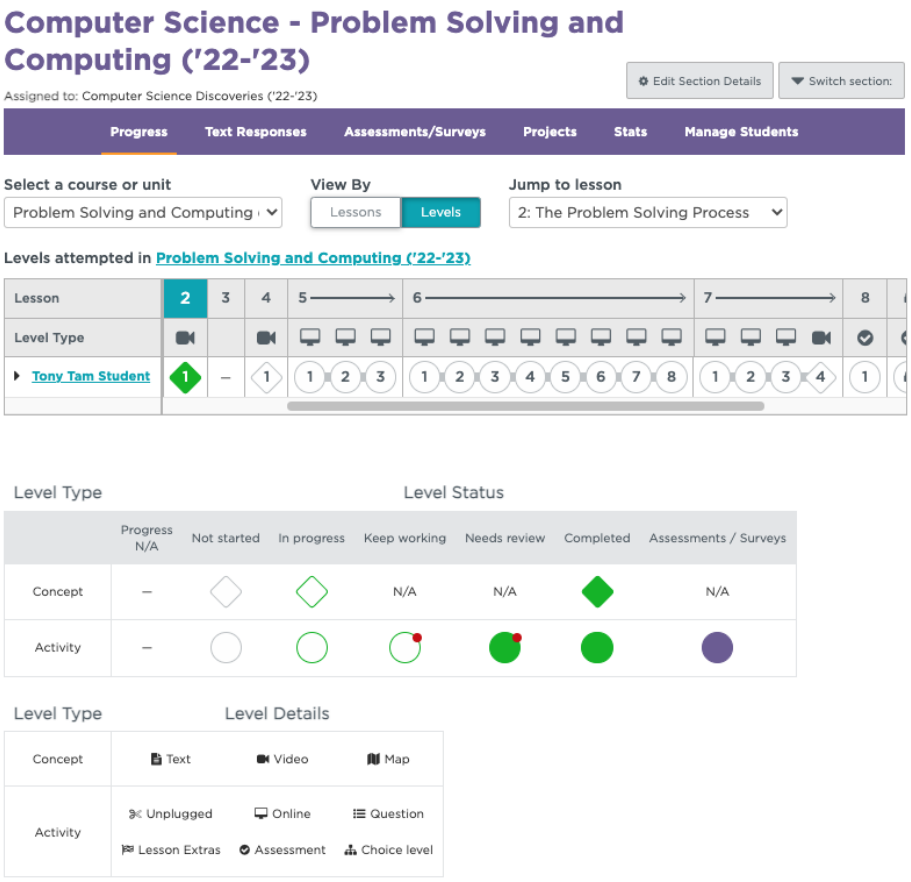

Figure F: Teacher portal showing student process

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.

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