## *The Power of Programming*

Programming is a useful skill at all levels of learning. It teaches how to decompose problems, how to think logically, and offers immediate feedback (and reward) to the student.

Nearly all computer programming is learned by doing. And programming and coding help develop computational thinking skills such as creating, problem solving, and analyzing, and are ways for students to actively applying their learning for core subject matter curricula.

The programming process includes designing, writing, testing, debugging/troubleshooting as well as optimization for specific platforms or processors, and understanding scalability and portability across platforms and processors. It leverages computational thinking and algorithms in approaching problems before using computer languages and coding to computationally solve those problems.
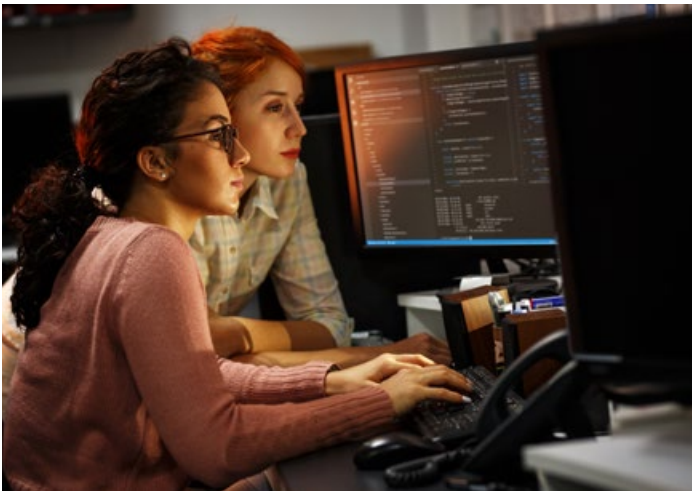


## Languages

There are literally hundreds of programming languages that students can learn, and some of the most popular languages are:

- **JavaScript:** Used extensively for front-end web development. Major social media platforms use JavaScript since it provides an easy way to create interactive web pages. JavaScript is preferred because of its compatibility with most browsers. JavaScript is also used on the server-side through Node.js. It is considered a model language especially for beginners.

- **Python:** One of the most general purpose, user-friendly programming languages. Like Java, Python is easy, intuitive, and similar to the English language. Python is popular in scientific computing, data science, machine learning, and engineering.

- **Java:** The most popular programming language for the last twenty years. Java is 99% object-oriented, is platform independent, and highly compatible across many platforms. Java is used for the Android operating system and is used by approximately 90% of Fortune 500 companies for back-end applications. Java is also a good beginning programming language because it is extremely flexible and used for a broad range of applications.

- **C/C++:** One of the most popular languages being the parent language to many others, and is used to build high-performance applications. The Linux OS is based on C. C++ is an object-oriented programming language built on C. C++ is commonly used for virtual reality, gaming, and computer graphics.

- **PHP:** Stands for "Hypertext Preprocessor" and is a general-purpose programming language which runs on a server and it is used to create web pages written in HTML. It is popular because it is free, cheap, easy to set up, and simple to use for new programmers. It is used in more than 83% of websites globally.

(intel)

- **C# (C-Sharp):** A powerful, object-oriented programming language. C# is commonly used for developing desktop applications, Windows 8/10* applications and requires a .NET framework to function. C# has features that make it easy to learn for beginners. C# is commonly used for web applications, desktop applications, and also for VR, 2D, and 3D gaming.
- **Ruby:** Open source programming language focused on simplicity and productivity designed with the theme of simplifying the programming environment and making it more fun.
- **SQL (Structured Query Language):** Programming language for databases used for web and database applications. SQL is in high demand and used by many organizations worldwide.

## Applicability

Once a program is written in a language (such as one of the languages above), it ultimately has to run on a processor. The features and performance of that processor play a significant role in the program's performance and behavior.

Programming can be taught in both primary and middle school with specialized languages for younger students such as Scratch*, which is a block-like, visual programming language with a large online community. Scratch* was developed by the MIT Media Lab and has been translated into 70+ languages around the world. Scratch* is commonly taught in after-school centers, schools, and even colleges. There are more than 39 million Scratch* projects shared at **https:// scratch.mit.edu**.

Given the rising interest in teaching programming in schools, many learning programs and support systems have been created. CoderDojo* (**https://coderdojo. com**) is an example of a community-supported program of about 1700 free local programming clubs with more than 58,000 young people and 12,000 volunteers in 94 countries.

Many careers programmatically solve problems, whether directly with coding or using productivity applications. And—through applying computational thinking competencies to programming and coding projects—students develop higher-order thinking and skills related to creating, analyzing and actively applying their learning.

"Coding is the easiest way to get into computational thinking. Teachers are focused on how we have to help children to persist and take feedback. Computing and coding are great ways to do this, since the results are so immediate. It's a good way to get at those dispositional aspects of learning and schooling."

—Jane Krauss, *co-author of Computational Thinking and Coding for Every Student: The Teacher's Getting-Started Guide.*