

# A Literature Review on Coding skills for Children in a Disruptive Technology Era

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**Abstract: Background:** It is a given that programs are going to become more and more prevalent in today's society. However, there are still doubts among people regarding what programming is, how hard it is to get into, as well as the benefits.

**Purpose:** To study and analyze how to guide children(10-12) to develop coding skills. This research paper aims to study and analyze the short and long-term benefits of introducing young children to coding from a young age. This includes skills learned, opportunities to continue into the field of computer science, as well as statistics for the increase in demand of IT personnel in all industries.

**Method:** Finding secondary data available from news articles, research papers, blogs, and videos.

**Result:** Coding is shown to be more and more essential in today's growing society. It is also proven to introduce essential life skills to young children, as well as give them opportunities for high-paying jobs in the future.

**Keywords:** Programming, coding, children, benefits, computer science.

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## 1. INTRODUCTION

In modern times, only about 0.26% (2014) [1] of the population are software developers [2]. As our society is moving towards an increasingly computerized and technological era, skills such as programming are becoming much more necessary [3]. In 2021, especially during the COVID-19 pandemic, programming is like reading and writing in the 16th century [4]. Because of this, there has been an influx of interest in the field, leading more people to pick up coding, with one in 20 adults taking up software development training in the last year.[5] Parents are also starting to want to introduce their children to programming classes and courses starting from a young age.

This is backed by the increase in demand for programmers in virtually every field. Most monotonous desk jobs could be automated or sped up using basic programming knowledge. More advanced skills are required for higher-paying jobs and faster optimization.

With the increase in popularity of video games, children are exposed to computers and programs from a young age. In turn, they might also spark an interest in programming, wanting to create games of their own. The paper will explore ways that they can continue pursuing this path on their own.

## 2. WHAT ARE CODING AND PROGRAMMING LANGUAGES?

Coding and programming is the act of inputting commands into a computer. Code tells a computer what to do, and can be used to create apps, websites. Programming can also be used to speed up monotonous practices or automate tasks. People often confuse coding and programming. Coding is the act of writing code, using a language computers can understand, while programming is the organization and planning of commands. [6]

Right now, programs are prevalent in every field. Aside from the obvious uses like website or application development, there are nearly endless uses for programs today. For example, hospitals use algorithms to scan patients for life-threatening diseases. "The program works by looking for specific molecular patterns in cancer DNA" and matching it to the patient's DNA [7]. Drones, which need programs to run, are used in different fields, such as agriculture, firefighting,

and exploration. Written code tells the drone how to fly straight, as well as how to measure the height of plants, when to deploy water and tools, and how to avoid obstacles by using its sensors and receivers. All of these require knowledge of circuit board programming to input our intentions into the drone. [8]. Other uses for programming include making sorting algorithms to help organize large amounts of data as well as using code to make graphs and tables [9]. Aside from practical use, programming can also be used for saving time and money. Knowledge of HTML can be used to bypass sign-in overlays. [10] Knowledge of programming can also be used to track the price of items on shopping websites and notify the user when the price drops. [11]

### 3. BENEFITS FROM CODING SKILLS

Understanding computers and programs teach children how to think logically since they have to plan out what they want the computer to do. Many problems also break it down into multiple parts. Additionally, because debugging and rerunning code is an enormous part of programming, children learn failure and how to quickly bounce back [12]. A 2018 study involves 57 children from kindergarten to grade 2 using the ScratchJr programming tool to perform tasks. The children would spend 12 hours learning programming concepts. At the end of the 12 hours, the children were asked to take a test on what they learned. The study touches on how children from 5 to 8 years of age rely on the same skills needed to program. Results show that “causal, spatial, verbal, and social reasoning all play a key role in children’s programming learning” [13]. Even governments are encouraging schools to implement programming classes. In 2014-2015, England made kindergarten programming classes mandatory [14].

Jayne Clare, a teacher, says that students learn essential problem-solving skills as well as teamwork while learning how to code and program [15]. Influential figures all over the world also support this claim. Steve Jobs, the founder of Apple, said that "I think everybody in this country should learn how to program a computer because it teaches you how to think." in an interview [16].

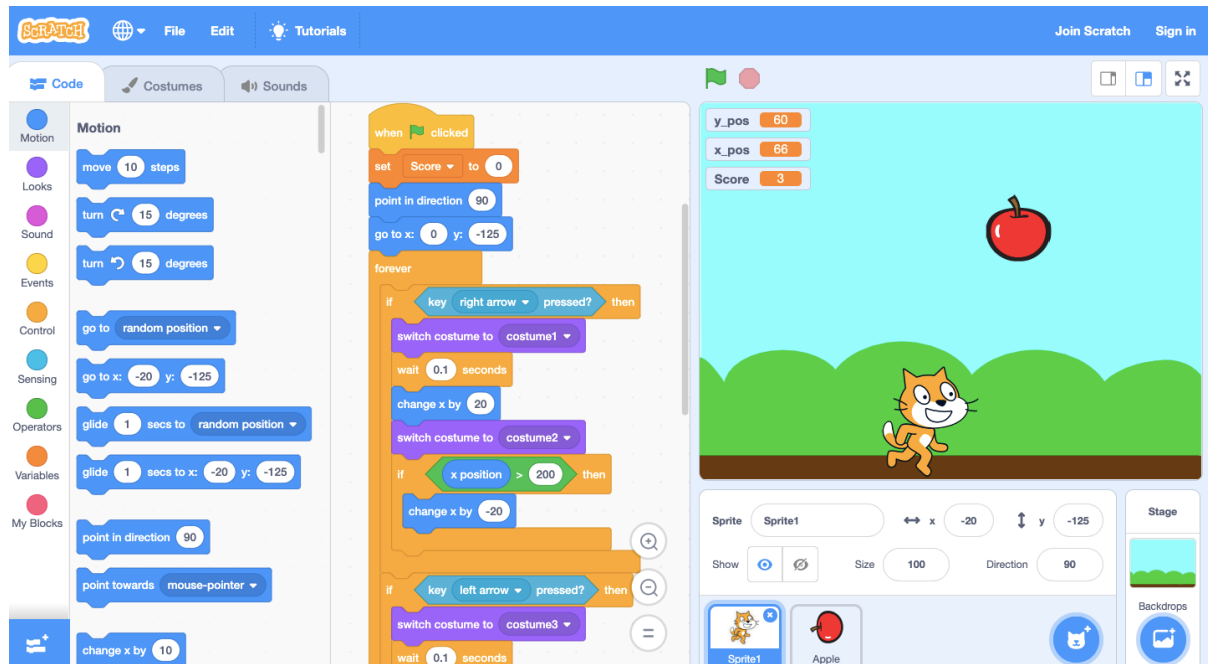
Most people currently believe that programming can only be useful if one is to pursue a career in the field. However, even if one has no intention to major in computer science, the knowledge of programming is shown to boost efficiency and save time in everyday office jobs. too. One example is in the prevalence of spreadsheet software like excel in desk jobs. Most spreadsheet software nowadays has ways to implement scripts and algorithms. The knowledge of coding and programming skills allows for easier automation [17]. For example, instead of manually checking if a number is above 3, one could easily write a script that can do that. Some algorithms can fix errors like spelling that require basic knowledge of programming to implement. Another use for programming in office jobs includes organizing data and displaying it. Knowledge of programming allows one to easily create tables, graphs, and visuals much quicker and cheaper than when one relies on external software and services.

On the global scale: A 2020 study from the National Association of Colleges and Employers in the USA revealed that Computer programming, computer engineering, and computer science were the second, third, and fourth majors with the highest starting salary, respectively [18]. Additionally, there has been a surge in demand for programming knowledge in Thailand. IT job searches on JobsDB have risen by 12% in April alone, with the most popular searches being IT project manager, senior IT infrastructure, web developer, and search engine optimization handler [19]. Job salaries for Thai programming jobs are also above average, with a 20000thb average starting salary, compared to the national average of 14600thb [20][21]. However, while there is a surplus of computer scientists and programmers, there are not enough qualified computer programmers in Thailand. This means that while And ones that are qualified prefer to work overseas in international companies. The younger generation also prefers working freelance and are more inclined to pursue non-stem fields, such as business administration and marketing [22]. It is estimated that in 2023, there would be a shortage of more than 2 million IT positions. [23]

### 4. HOW SHOULD YOUNG LEARNING START CODING?

So could young learners get into programming? Countless websites, apps, and videos already exist on the internet that can teach a child to code for free. These websites would introduce computer science concepts like variables, operations, comparators, and functions. If the learner is ready to learn an actual language, Python is recommended by many to be the perfect starting language, due to its easy-to-read syntax and learning curve. Other popular languages include C, Java, and C++. Popular websites include Scratch.mit.edu, Codecademy, and codehs. Scratch is designed for young children between the ages of 8-16.[24]. Other software such as Codecademy and codehs, however, focuses more on programming

languages. Programming, however, is affected by many stereotypes, mainly the preconception that programming is incredibly math-heavy and typing-heavy. However, while advanced codings and algorithms require math knowledge, basic programming is more focused on logic and critical thinking. A child would have to learn how to loop and think in steps. There are also many drag and drop languages like Scratch, that have a kid-friendly interface and do not require typing at all.



The picture above shows that scratch has an easy-to-understand interface, requiring minimal knowledge of coding syntax [26]. A 2013 study indicates that before introducing programming to pupils, “it is important to develop their ability to think algorithmically”, which means “the thought process involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent” [26] [27].

## 5. CONCLUSION

Programming has been proven again and again by countless studies to be an essential skill in today’s society. Only a fraction of the population can currently code, and demand for computer programmers is steadily rising each year. Programming is also proven to help develop other essential skills in children and young adults. Studies showed that children use all types of reasoning while programming. Other studies show that programming also teaches failure as well as teamwork skills. Even if one has no plans to pursue a career in computer science, coding is still useful due to its prevalence in all fields, from medicine to agriculture. Programming skills are required to understand the new technology getting developed every year. Because it is so important to pick up coding from a young age, there already are numerous services on the internet that provide programming education for free, and it has been shown that programming is not as hard nor as math-heavy as stereotypes would suggest. If one already has the basics of programming, there are a plethora of services and opportunities to improve and practice. For example, Google hosts a code jam every year, free to participate. Leetcode.com provides puzzles and challenges one has to solve. As the paper points out, coding has become a necessary part of one’s professional and personal life. It is also an easy skill to pick up from a young age, with plenty of proven benefits.

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