Design and Exploration of Programming Education System for Teenagers

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Abstract: With the State Council issuing the “Artificial Intelligence Development Plan” and gradually promoting programming education, the current programming education for teenagers has become a hot topic. Some provinces and cities are also at the forefront of the popularity of programming education, but at present children's programming education system is not perfect. This article analyzes the current programming tools that are suitable for young people, and summarizes a set of perfect programming education system according to the characteristics of young people's development at different stages of development, and applies it to practical programming education practice.

Keywords: programming education; programming thinking; system design

1 Introduction

Now we are in an era of developing rapid, new things are constantly emerging, and new technologies[1] that bring us a convenient lifestyle, such as electronic payments, shared bicycles, big data, AI artificial intelligence, robots, and objects networking, the chain, and so on, in fact, these various applications are inseparable from programming.

In May 2017, “the alpha go robot” defeated Ke Jie, the top human player in the “Go” wars, sparking great attention on AI artificial intelligence and machine learning, as well as Baidu robot “smallness” in “Most Powerful Brain”. He also defeated the top human brain players in the game. People are also very anxious and have caused great anxiety. Will future human work be replaced by machines?

In fact, we really don't need to be so anxious because the machines are run according to the procedures set by humans. In other words, what kind of order we sent to it and what tasks it will accomplish. Just as communication between people requires language, the language which is used between humans and machines is the programming language. We tell it what to do with words that the machine understands, and it executes our orders in one piece.
Since the machine is so "obedient", how does it overcome humanity? It benefits from two major advantages of computers: 1. Mass storage: Computers can store large amounts of data and information, 2. High-speed computing: very complicated calculations can get results in an instant.

Take alpha go as an example, its main working principle is deep learning. In simple terms, it is to store in the machine the chess of the millions of human Go masters. The machine can predict legality by using powerful and fast computing power. For example, if the odds of winning this move are calculated to be 72%, and the odds of winning another move are 85%, the machine will of course choose the method with the highest probability of winning.

In terms of mass storage and rapid calculation, human beings cannot compare with machines. What are our strengths? The advantage of human beings is creativity! In the future, dangerous and repetitive tasks can be done by machines. We live a little bit nearer, such as sweeping robots that are used by many homes. It completes sweeping or mopping tasks according to programmed procedures. It can work tirelessly and work hard. Machines can also replace news reporters to report news. They can replace “City Spiderman” to clean high-rise buildings.

Therefore, true artificial intelligence will not only eliminate jobs, but will create more jobs and more jobs that we could not imagine. Research shows that 65% of primary school students who are now growing up will engage in occupations that have not yet been born. How can we improve our children's competitiveness in the future of artificial intelligence? What children should learn now should be future-oriented thinking and skills. To better understand the machine's thinking mode of work and work with the machine in the future, learning programming is an inevitable choice. Everyone needs to develop programming thinking. Apple founder Steve Jobs said: Everyone should learn a computer language, because it will teach you how to think.

2. Status at home and abroad

Looking at the world, many developed countries are actively promoting children's programming education. The penetration rate of American children's programming has reached more than 40%. Many children in the United States begin to engage in programming lessons when they were six or seven years old. The former President Barack Obama initiated the "Programming One Hour" campaign aimed at getting American primary school students to begin programming[2]. Writing programs has almost become a daily life skill. Obama thinks his two daughters are too late to learn and they are not satisfied with their programming education.

Apple founder Steve Jobs started programming at the age of 11, founded Apple at the age of 21, and iron man of Silicon Valley, Elton Musk. His life began at the age of 10 and he started to learn programming. The game Blaster he created when he was 12 was purchased by a magazine company for $500 and earned the gold of life. Founder of Microsoft- Bill Gates: 13 years old began programming; founder of Umber-Klahanie: programming began at the age of 6; in fact, the founders of most domestic technology companies are also programming experts. Founder of Tecent Ma Huateng, Baidu founder Li Yanhong, Qihoo 360 founder Zhou Hongyi, NetEase founder Ding Lei, Sina founder Wang Zhidong, Xiaomi founder Lei Jun,
Innovation Factory founder Li Kaifu, Jingdong founder Liu Qiangdong, WeChat leader Zhang Xiaolong...Yes! They all rely on programming as a big technology.

In real life, you can get a taxi by going out with your mobile phone, and you can go cycling with your code. Computer intelligence is everywhere, and to create all this programming technology, kids from the ages of seven to fifteen are the best learning ages.

For programming, some parents have questions: "Programming is not a programmer's job? Does a child need to be exposed to programming so early?" In fact, everyone can learn programming, but it does not mean that everyone should be a programmer [3]. The biggest advantage of learning programming is that it can train people's thinking integrity and logic, and can cultivate new ways of looking at problems and dealing with problems.

The foreign primary schools did a very good job and kept their children's curiosity and exploration spirit. In China, there are often thought-sets in the 5th and 6th grades and imagination is limited. Learning programming is therefore a good way to cultivate curiosity.

The university computer programming course system has been relatively complete. However, the current IT, IT and IT courses in primary, middle and high schools are mostly at the simple multimedia software application level [4]. For programming learning is basically zero, coupled with the pressure of college entrance examinations, even some provincial and municipal IT courses are occupied by other courses. These have seriously affected the establishment of programming thinking in adolescent students [5]. Sudden contact with the program design course after entering the university, due to the lack of basic computing thinking and programming thinking ability [6], resulting in a large number of student programming courses learning difficulties, and then lost interest in learning, and ultimately lead to poor learning results.

On the other hand, mathematics education for logical thinking has been developed. Primary schools, junior high schools, and high schools have established a scientific, step-by-step educational system [7]. Therefore, when students study advanced mathematics, linear algebra, probability statistics, etc. The basics of mathematics, basic logic and ability to enter the learning state quickly.

Programming learning must also start from the doll. At present, the main problem at the policy level is that the education authorities do not pay enough attention to adolescent computer education and programming education. Of course, with the development of society, the social requirements for people's programming ability will change, and this problem will surely be gradually improved. On the technical level, the first issue is the lack of a programming education system suitable for young people.

3. Adolescent Programming Education System Design

The code written by high-level languages such as Java and C++ used by programmers is very complicated and not suitable for children to learn. For children, the goal of learning programming is to develop programming thinking and logical thinking skills. Scratch, a programming language specifically designed for teenagers developed at MIT in the United States, allows children to learn programming just as easily as building blocks. MIT's argues that to create and share your own interactive stories, games, music and art. It means “Create and share your own interactive stories, games, music, and art.” Everyone can see that the "create creation" is the first place, and the purpose of learning Scratch is to cultivate
children's creativity and hands-on ability. More crucially, programming provides children with another way of seeing the world and offers new possibilities. From a certain point of view, programming languages are more of an international language, just like customs passwords, and they are free. Unlock the Internet information society.

For kids, Scratch's operation is very simple, select the background, and add the role, use the mouse drag and drop method, drag the required statement block to the script area, and then set the parameters, the role can be activated. Each different color block represents a different type of program statement, so that the color can be judged very intuitively, and the connections between the statements are as easy to operate as building blocks.

Programming and mathematics are also inseparable. The learning process also involves a lot of mathematical knowledge and concepts, such as Cartesian coordinates, positional shifts, angles of rotation, etc., where this mathematical knowledge is no longer just books. The text, which became the basis for making your own animations, looked at the movement or rotation of the character in the coordinate system according to its own set value. Students must have a deeper understanding of these mathematical abstractions.

In the classroom, you can also display some classical mathematics problems such as tree planting, farmers crossing the river, chickens and rabbits in the form of programming and animation. PBL project-based learning like this will first describe the problems to be solved by the children. For example, the farmer crosses the river: A farmer brings a wolf, a sheep, and a cabbage to the south bank of the river. He will ship all these things to the North Shore. The problem is that there is only one boat in front of him. The ship is small enough to hold him and one item. Only the farmer can punt. In addition, because the wolf can eat sheep and the sheep love to eat cabbage, so the farmer cannot leave the sheep and cabbage or wolf and sheep alone on the side of the river to leave. What plan should the farmer take to transport everything through the river?

Then we analyze the problem first, help the child to find a solution to the problem, design an animation to describe the program. Which characters are needed in this animation? What actions does each character need to complete? What are the different needs for completing these actions? The building blocks of color blocks guide the children to think step by step, and then complete the programming process by themselves. Finally, the results of the tests are checked, and the programming process of similar problems is summarized, and the children are inspired to make deeper thinking.

This process requires the use of Scratch's multi-color block calculators, which combine arithmetic statements with other color block statements. It will also enhance the child's logical thinking ability, develop child's programming thinking, carefully and carefully design each character's script, and the collaboration and waiting between the roles.

The game is a child's favorite thing, interest is the best teacher. The boy was also a child because he liked the game to learn programming. After learning advanced stages, children can make games like Plants and Zombies, Super Mario. Let the children play in the middle school and create a new future in play. Because children do not have so many walls in their minds, the childhood period is a period of great creativity in human life. It is possible that students can also design and produce popular games like “Traveling Frogs”.

After learning the advanced stage, you can also switch Scratch to an English-language user interface to familiarize your child with the meaning and usage of English program
sentences. It can be said that programming this skill combines the knowledge of language, mathematics, English, music, arts and other subjects, and enhances the child's ability to solve practical problems.

According to the learning characteristics of young people at various stages of development, a set of programming education system was concluded. The system was divided into ten phases, from Level 1 to Level 10:

1) In the first stage, Scratch is used as a programming language for youngsters to learn. This graphical programming method is suitable for zero-based children learning. It uses graphical representations and drag-and-drop interactions to complete the core logic of programming and deliverables.

2) The second step is to learn the Scratch. To reinforces and upgrades basic operations, integrates all modules in Scratch, and master some basic programming patterns.

3) The third phase focuses on Scratch's proficiency, using the knowledge learned earlier, spiraling to improve difficulty, and the goal of being proficient in using and proficient in what you learned.

4) The fourth stage is to learn PBL project, flip the classroom, and give the students to see the results. Then think about trying to make the same effect, and finally the teacher announces the implementation method.

5) The fifth stage is learning programming robots, writing instructions for robots through Scratch graphical language to control robot movements.

6) The sixth stage is the advanced programming robot, which realizes the combined action control of the creative programming robot and other operations.

7) The seventh stage is the introduction of Python, using the high-level language Python to achieve the example that was done before and complete the natural transition.

8) The eighth stage is advanced for Python. In the latter stages of the ninth stage and the tenth stage, deep learning of informatics competition programming can also be carried out to form a complete adolescent programming education learning system.
4. Conclusion

In the future society, the coexistence of man and machine will be unavoidable. Those who can understand the mode of operation of the machine will take the initiative. The so-called knowing oneself and knowing one another is a good thing. We should not compare the merits of the machine with our own ones, but we should use our strengths, avoid weaknesses, and do things that are less easily replaced by machines, and cultivate ways of thinking and skills that can be oriented toward the future. Keeping your child's curiosity and exploring the heart, the child will return us with amazing creativity!

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References