Research on Robot Education in Primary School

Ruiying Xu
Baicheng Normal University

Keywords: robot; education; curriculum

Abstract: This paper mainly discusses robot education in primary school. Robot education refers to theories and practices of learning basic knowledge and skills of robot, or optimizing education and teaching results by robot education. The entry of robot education into primary school explores the educational function and value of robot, promotes quality-oriented education, and trains information literacy and technical literacy of primary school students, which has an importantly practical and strategic significance on promoting the innovation and practical capacity of primary school students.

1. Research Background

Robot technology, as an important indicator of implementing “Made in China 2025” and developing “Industry 4.0”, is an indispensably key technology in the global industrialization, developing with the high speed of 20% each year. Robot technology drives the development of scientific and technological innovation. In The 17th Academician Assembly of Chinese Academy of Sciences and The 12nd Academician Assembly of Chinese Academy of Engineering held on June 9th, 2014, Xi Jinping pointed that “We not only need to improve the robot technology, also need to occupy the market as much as possible; robot reform is expected to become a breakthrough point and an important growth point of The Third Industrial Revolution, to affect the global manufacturing pattern, and China will become the biggest robot market in the whole world.” There have been a dozen years for the entry of robot education into China’s primary education system. However, all are competition programs. In recent years, several primary schools began introduce robot teaching into classroom. Whereas, it began relatively late, and there is not mature teaching mode for robot teaching for reference.

2. Research Significance

For recent years, various kinds of robot competitions are held in China one by one, and there are more and more students participating in robot competition. However, schools and students are faced with a dilemma, which is the lack of robot curriculum resources, especially for pupils. The lack of supporting curriculum resources is the main cause. In 2015, Chinese Institute of Electronics launched Qualification Certify for National Youth Robotics Level Test. Primary and secondary school students in China can verify their robot robotics level with the aid of this platform. It specifies the standards for robot education in primary and secondary schools, identifies its development direction, and promotes its healthy and stable development. Education-based robot curriculum in primary school can not only promote the development of robot education in primary school, also enrich the robot curriculum in schools. As for the training of students’ practical capacity, China strongly advocates the quality-oriented education in primary and secondary school, however, actual education is mainly exam-oriented education, which pays attentions to general knowledge courses, and ignores the training of other capacities of students, especially the training of students’ practical capacity. Robot education can reasonably and effectively solve the contradiction. At present, only a small amount of students participating in robot competition are benefited. Generally, practical capacity is one of capabilities that students lack most. Robot education can train students’ practical capacity to greatest extent and promote the rapid development of robot education in schools.

At last, robot education can reduce the burden of robot teachers. In primary school, teachers of robot education only account for a small percentage of all teachers, and most are part-time information technology teachers. High workload and the relatively low status of root education is main reasons for the lack of robot education teachers. They are required to perform the teaching of robot, compile textbooks according to robot equipment without reference of current resources, and produce teaching resources, which increases invisibly the workload of robot teachers. With a set of robot education curriculum suitably for primary school students, teachers only need to prepare lessons like teachers of other disciplines and implement teaching, which can reduce the burden of teachers.

3. Discussions on Robot Education

Robot education provides a space for students to fully display their imagination and solve problems, and shows its unique characteristics in training students' learning interest and innovation capacity, conductive to training students' practical ability, innovative thinking ability, comprehensive application ability and so on, creating a new path to cultivate innovative talents and promote quality-oriented education. In implementing robot education in primary school, it is necessary to pay attention to these three aspects.

3.1 To enhance the understanding of robot education

Robot education has been adopted in many schools, however, it is traditional robot education, which is mainly are design courses about parts of robot, including master control, electric motor, sensor, etc., to learn robot knowledge by pieced tasks. Some schools consider robot education as activity contents of extracurricular interest groups, or competition, however, the real robot education did not get popularized. So what is robot education? It, in fact, is to focus on the learning of robot knowledge, not to finish innovative tasks by robot, which is a difficult and boring learning task for pupils with not too much knowledge reserve. Therefore, in classroom of robot education, teachers, firstly, are required to propose questions or tasks to encourage and guide students to think and innovate, then help them analyze the operability of their ideas, and lastly give the learning initiative back to students. In the development concept of robot education, students are not passive learners anymore, but multiple roles, such as scientist and inventor, as the subject of learning, and teachers are just guides in teaching activities. Under the guidance of robot education, students learn according to their actual needs. Robot is not only the content to be learned, also the tools to finish tasks and realize needs. In this way, students can learn the problems to be solved and the essence of robot teaching, and their desire to explore and learn are inspired, which increases new force for robot teaching.

3.2 To optimize teaching contents and curriculum construction

In the process of learning knowledge, teachers are just guides for students to encourage them to make clear of actual needs of the course and guide them to practice. Therefore, to optimize teaching contents is an important part of robot education in primary school. It shall be combined with current basic educational curriculum reform. The implementation of robot education depends on the support of courses. In schools with robot education, most robot education courses are conducted by information and technology education. Teaching materials are main carrier of course. Whereas, there is a serious contradiction between problems produced by text properties of traditional teaching material, including limited resources, delayed update and inflexible contents, and the interaction, immediacy, and generativity of robot education. At the same time, many schools cannot guarantee enough class hours. Therefore, in order to speed up the robot education, it is necessary to set up robot course and robot school-based course, arrange certain class hours, set specific classroom and equipment, adopt unified textbook, build unified course standard and optimize teaching contents, so as to promote the course construction. This paper describes several forms of robot education in primary schools for reference.

Extracurricular activity. Traditional school education is the main channel to reach conceptual

understanding of science, whereas, extracurricular informal and activities also have great influence on the learning of scientific knowledge. Extracurricular activities are not limited by teaching plan, teaching program and educational form, with relatively wide range of activities and rich contents. Robot education, as the content of extracurricular activities, brings scientificity and enjoyment to extracurricular activities, and cultivates students' innovation spirit, comprehensive practical ability and cooperation ability.

Technical course. The inclusion of intellectual robot into information technology course as the content is the stage of formation, and the compiling of teaching materials and regular set-up of course are in the initial stage. However, it will bring new dynamics to information technology discipline, and improve the current development of application programming of robot education software.

Research-oriented course. Robot education is included into primary school in the form of research-oriented course. With more attention paid to research-oriented course, and the long-term and personalized feature of robot education, the form of research-oriented course will be more conductive to the cultivation of students' innovation ability. However, due to the insufficient class hours of research-oriented course, and great difficulty in organization of class, departments of education shall plan the entire promotion of robot education.

3.3 To strengthen teachers' professional quality

With continuously updated information technology, robot education shall also be innovated, which requires the educational concept and vocational quality of teachers in robot education to stay close to changes of information times, fully explore students' intelligence, actively guide students to participate in activities, and develop students' innovative thinking to obtain new knowledge. The development of robot education cannot be separated from the development of teachers in robot education. To accomplish and realize the teaching objective of robot education, teachers shall have profound professional knowledge, which is the powerful guarantee of robot education.

At present, in many schools, teachers of robot course are mainly from information technology course or general technology. Thus, it is urgent to improve the professional level of teachers for robot education. The nation shall set corresponding robot education major in normal colleges and universities, and strongly cultivate course teachers in robot education major so as to promote the future development of robot education. Current part-time teachers can also take participate in robot course training at all levels, visit other schools or hold Internet course to enhance their teaching level and accumulate experience.

Most schools adopt the collective preparation of lesson and cooperative system in teaching, and some schools apply the system of "double teachers", which is that one teacher teach class in the stage, and another teaching assistant tutor students in the classroom, so as to timely find out and solve various problems in learning. Especially, in building robot, it can solve students' difficulties, and better manage robot equipment. Meanwhile, to mobilize students' learning initiative, teachers are required to design teaching task of each lesson to involve ever student in the classroom, so that they can actively practice, thus cultivating students' learning interest and promoting the development of robot education.

4. Discussions on Robot Teaching Methods

There are many teaching methods of robot discipline, and nearly various basic teaching method and comprehensive teaching method can be used in the teaching of robot discipline, which shall take objective requirements of teaching, the difficulty in the content of teaching materials, and the difference between learning foundation of teaching object and teaching conditions.

As for the teaching of robot theory basic knowledge, the story leading-in can be adopted. Children like to listen to stories, because stories is an important channel for them to know this world in the beginning. They can obtain a large quantity of information from stories. It is necessary to connect boring knowledge with stories, echo students' life experience, extract robot knowledge and skills and solve problems in their life. This method can effectively increase the learning interest

of low-grade students, help them widen their thinking and enrich the imagination to be naturally involved in best learning state.

The teaching of robot programming can apply case-based system. Teachers illustrate examples and cases in real life related to new lesson and guide students into new knowledge. With vivid examples and cases, students can better feel the sense of reality, and their interest can be inspired to enliven the classroom. The task-based method can also be applied, which is task-driven. Teachers propose a question first, then guide students to learn new knowledge to solve the problem. Only new knowledge can solve this problem. This is also a commonly used method.

The method of discussion can be used in the teaching of robot philosophical content. The teaching of robot application content can adopt the method of demonstration. Specifically, before teaching lesson, teachers use objects, instructional aids or courseware to guide students to observe and analyze visually and introduce new knowledge. For instance, in *Robot Design*, teachers can display and point out the position of each part of robot to help students to know the design of robot.

The teaching of robot design and production can apply the method of guidance and the method of independent exploration. With the instructions of teachers, students are required to accomplish by themselves more important parts. This stage is full with great difficulty, where, teachers summarize knowledge learned before and examine students' practical ability.

5. Thinking on Current Development of Robot Education

Robot education, as the carrier form of innovation education in modern information technology course, plays a significant role in training students' innovation ability, strengthening students' innovation knowledge and spirit and enhancing students' comprehensive practical ability, and it is an important measure for the nation to develop talents. However, in order to develop robot education successfully, it is necessary to timely correct wrong consciousness and unstandardized behaviors. In this paper, firstly, it is required to stress the importance of robot education and guide its healthy development. There may be insufficient conditions for robot condition to be fully popularized, which requires departments of education to pay more attention, and related departments to provide certain support in economy and teaching staff, to intensify the supervision on robot education and robot competition, and to provide certain assistance for the discipline research of robot teaching to grasp its development direction, so as to promote robot education to develop healthily and enhancing students' comprehensive abilities. Secondly, it is necessary to increase the attention on research and development of robot and improve its utilization. The manufacture cost of robot is an important problem hindering the popularization of robot education. Many schools and students give up because of economic pressure. This paper believes that to change the situation, it is necessary to encourage robot manufacturers to transform concepts, update technology and research some robot equipment suitable for robot education to popularize robot education. In teaching, the entire robot equipment is not necessary for every time of teaching. Robot equipment with single function can be applied in teaching and practicing according to modules when necessary. In this way, the cost of equipment purchase can be decreased to certain extent. Lastly, it is required to speed up the discipline construction of robot to reach standardized teaching. Robot education occupy vital role in the teaching of artificial intelligence. Robot education can be better combined with basic curriculum reform to fully show curriculum reform concept and exert the role of robot in training students' innovation ability.

The implementation of robot education in primary school is theoretically significant and practically valuable. From research reports of robot teaching, it can be seen that by robot teaching, students' logical and innovation thinking, comprehensive practical ability, and the ability of overall planning, solving problems and continuous use of deduction have been obviously enhanced, which is beneficial for students.

More importantly, some domestic experts and scholars incessantly summarize the law of robot teaching, extract strategies of robot teaching, explore mode of robot teaching, guide teaching practice with new curriculum theory and verify and update theory in practice. They contribute their wisdom and strength to improving information literacy of pupils and the exploration of robot

teaching. It can be foreseen that with the great efforts of national teachers, in the near future, China's robot education will rank the forefront in the whole world.

References

[1] Zhang Guomin, Zhang Jianping. The Issue of Robot Education in China K-12 Education And Its Countermeasure [J]. Modern Educational Technology, 2008, (5): 92-94.

[2] Zeng Qingbin, Feng Weiqiang. Evaluation on Virtual-real Robot Teaching in Primary School [J]. Educational Information Technology, 2014 (9).