Key Technology Prediction and Strategic Analysis of Educational Robots Based on Patent Map Analysis

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Abstract. This paper uses the patent data of China HowNet and the SOOPAT patent database, uses patent maps as an analysis method, and uses life cycle theory and Logistic models to analyze and process key patents related to domestic and foreign educational robots and to make the key to domestic and foreign educational robots. The life cycle prediction research of the technology shows that the key technical fields of educational robots in the world have passed the nascent stage, and the key technologies of educational robots such as artificial intelligence, interactive technology, and manipulators are rapidly developing and are in a high-growth stage.

Keywords: Patent Map, Technology Life Cycle, Educational Robot, Key Technology

Preface
With the advent of the era of artificial intelligence, traditional education has continued to integrate into intelligence, and educational robots have gradually come into people's lives[1]. Under such circumstances, more and more research scholars are conducting research on educational robots, and continue to expand research technologies[2]. Foreign research on educational robots has been earlier, and the research results have been applied to real education systems, while China started its research late, lacking a discussion of the research history of educational robots, the current state of technology and future development directions. The purpose of this paper is to use S-curve method and Logistic model method to predict the technical life cycle of educational robots at home and abroad, to obtain the research history and current status of this field, and to speculate its future development trend, so as to provide some reference for research in this field.

1 Analysis of Patent Strategy under the Technology Life Cycle
The technology life cycle is generally divided into four stages, namely the birth stage, growth stage, maturity stage, and decline stage. For the development of technology, a small number of companies or enterprises conduct research in the birth stage of technology, and have front-end technological competitiveness. At this time, the industry standard for the technology has not yet been formulated, and more companies and companies are maintaining a wait-and-see attitude towards the technology,
so the industry development of the technology is slow[3]. The technology growth stage often has the following characteristics. The number of companies and companies researching the technology is increasing rapidly, the quality and quality of the technology is increasing rapidly, the market demand is increasing, and the market size is gradually expanding[4]. When the technology matures, the companies and companies studying the technology will gradually decrease, core technology is developing slowly, and more is the development of peripheral technologies and the improvement of additional functions. At the stage of technological decline, it shows that the market for this technology is gradually shrinking. Few companies research this technology again, and the market demand decreases This technology has gradually become the basic technology. Generally speaking, industrial strategy is to withdraw or transform and upgrade.

2 Technology Life Cycle, Patent Trend Analysis
The statistics of the key technologies of educational robots worldwide and in China were collected in the patent database, and the numbers of key technologies related to educational robots at home and abroad in the following years were obtained, as shown in Figures 1 and 2 below:

![Figure 1](image1.png)

**Figure 1** Annual cumulative number of patents related to education robotics in the world

![Figure 2](image2.png)

**Figure 2** The cumulative number of patents per year related to educational robotics in China

As shown in Figure 1, the cumulative number of patents for key technologies related to educational robots worldwide was 0 from 1960 to 1978. After 1978, the number of patents increased gradually until 2000, but the increase was small. In 2000 It will increase rapidly in the future. As shown in Figure 2, the number of patent applications for key technologies related to educational robots in China was small and the growth rate was small before 2010, and the cumulative increase in the number of patents after 2014 has increased rapidly[5]. It can be seen from the trend graph of the cumulative number of patents related to educational robots worldwide and in China that they meet the requirements of the S-curve and the Logistic model.

The data of the life cycle prediction of educational robot patent technology is based on the annual
application volume of educational robot industry patents, and the cumulative amount of educational robot patent applications in each year is calculated in turn, with the cumulative annual patent application volume as the dependent variable and the year as the independent variable[6]. Matlab The software uses the logistic model regression for each year's cumulative quantity, and finally obtains three unknown quantity parameters and S-shaped curve equations to facilitate the prediction research of the patented technology. The types of predictions in this article are divided into two categories. First, the technology cycle of the educational robot industry in the world is forecasted, and then the technology of the education robot industry in China is forecasted.

3 Research Conclusions
This study mainly uses the S-curve theory and the Logistic model to study the key technology life cycles of educational robots at home and abroad, and draws the following conclusions through research:

3.1 Key Technology Life Cycle Estimation Results
According to the trend of the cumulative number of patents on key technologies related to educational robots each year, the key technologies of educational robots are rapidly developing in recent years. Combining the S-curve of the patented technical cycle of educational robots and the logistic regression fitting curve can be used to infer education in China. The key technologies of robotics and key technologies of educational robots worldwide are in the rapid growth stage of the technology life cycle, and are the early stage of growth.

3.2 Technology Life Cycle and Patent Strategy
Through research, it is found that the key technology of educational robots is currently in the early stage of rapid growth of life cycle development. The number of industrial technologies and patents has increased rapidly. Whether the rapid development of educational robot technology is seizing opportunities in the industry market and it has become the mainstream of technology, which directly affects China's high-tech development and the international status of science and technology level. Therefore, China should strengthen the research and development of high-tech, joint enterprises, universities, governments, etc. join the innovation and technology alliance, cooperate and innovate, and break through core technologies Accelerate the layout of patents, and gradually establish technical industry standards to take the lead in the international market and take the initiative in industrial development.

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