

# A Research Summary and Prospect on the Cultivation of Top-Notch Innovative Talents in the Last 10 Years

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## ABSTRACT

In the past ten years, the theoretical research and practical exploration of the cultivation of top-notch innovative talents have been paid more and more attention. The content involves the selection criteria and mechanisms of top-notch innovative talents, talent characteristics and growth laws, and the training concepts and modes. Based on the research results of the past ten years, this paper looks forward to the future theoretical research and practical exploration direction of the cultivation of top-notch innovative talents, so as to better provide a reference for the construction of top-notch innovative talents.

**Keywords:** Cultivation of top-notch innovative talents, Research summary, Prospect

## 1. INTRODUCTION

In 2009, the Ministry of Education, the Central Organization Department, and the Ministry of Finance issued "the Test Plan for Top Student Training in Basic Subjects", also known as the "Mount Everest Plan". It is a top-notch innovative talent training program launched by the country in response to a difficult proposition of China's education development—"Qian Xuesen's Question". As of 2019, the five disciplines of mathematics, physics, chemistry, biology, and computer have been implemented as pilot projects in 18 universities across the country, trying to make breakthroughs in the cultivation of top-notch innovative talents in basic disciplines, such as Peking University's "Yuanpei Pilot Program", Tsinghua University's "Tsinghua School Talent Training Program" and Nanjing University's "Talent Training Program", etc. In order to further strengthen the cultivation of top-notch innovative talents, the Ministry of Education's 2020 No. 1 document clearly proposes that the "Strengthening Basic Disciplines Program" will be carried out in some colleges and universities from 2020, focusing on the selection and training of those who are interested in serving the country's major strategic needs and have excellent comprehensive quality or outstanding in basic disciplines. It can be seen from the above that under

the wave of higher education reform, it is the inevitable task and mission of colleges and universities to promote the transformation of talent team construction and cultivate top-notch innovative talents, as well as the future development direction and goal of higher education.

In recent years, the research on the cultivation of top-notch innovative talents has always been one of the important topics that the academic community has focused on. From 2009 to 2019, it has been a decade of continuous exploration and in-depth research on the cultivation of top-notch innovative talents in China, and it has accumulated rich research results. This article summarizes its main research directions and research results by combing and analyzing the relevant literature of the research on the cultivation of top-notch innovative talents in the past decade, and puts forward some reference suggestions for the theoretical research and practical exploration of the cultivation of top-notch innovative talents in the future.

## 2. LITERATURE OVERVIEW

As of February 2020, searching on CNKI through the theme of "Top-notch Innovative Talents", a total of 1,619 literatures have been found. Among them, there were 1519 articles from 2009 to 2019, which

generally showed an upward trend and fluctuated slightly in some years. Specific statistics are shown in Table 1.

The academic papers and journal papers on the cultivation of top-notch innovative talents in the past decade mainly focus on the following three themes: one is to discuss the selection of top-notch innovative talents from the perspectives of selection criteria and selection mechanism, taking universities as an example; the second is to analyze the research samples of the State Preeminent Science and Technology Award winners, natural sciences top innovative talents and social sciences top innovative talents, etc., to raise perceptual knowledge to rational

analysis, and to reveal the core characteristics of top innovative talents and the objective laws of growth; thirdly, from training concepts and training In terms of models, it analyzes the important issue of how to cultivate top-notch

innovative talents. In addition, the research directions of other literatures are scattered on the evaluation of the effects of top-notch innovative talents cultivation, case analysis of the implementation of top-notch innovative talents cultivation in universities, the construction of the external environment for top-notch innovative talents

**Table 1 Number of literatures with the theme of "Top-notch Innovative Talents" from 2009 to 2019**

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Quantity	38	88	133	155	167	160	145	153	135	171	174

cultivation, and the summary of the experience of top-notch innovative talents cultivation in other countries. From the perspective of research status, the big discussion of "Qian Xuesen's Question" and the launch of the "Everest Project" triggered by the death of Mr. Qian Xuesen in 2009 directly promoted the research boom in the field of higher education regarding the cultivation of top-notch innovative talents. The research of innovative talent training involves many research directions, and has obtained relatively rich research results in the past ten years. New thinking and new ideas have constantly emerged, and it has provided certain theoretical guidance for the practical exploration of the cultivation of top-notch innovative talents in China.

### 3. LITERATURE ANALYSIS

#### 3.1. Selection Criteria and Mechanism

The selection of top-notch innovative talents is a prerequisite and an important guarantee for the development and rational use of talents, and it is the foundation for laying down the quality of talents. Therefore, how to scientifically select talents that conform to the development of the times, adapt to the needs of the posts and have academic research potential is the primary problem to be solved in research on the cultivation of top-notch innovative talents.

##### 3.1.1. Selection criteria

Different colleges and universities have certain differences in the selection criteria due to the different

emphasis on talent training objectives. Generally speaking, the general practice is to increase the assessment of scientific research quality, development potential, mental ethics and other aspects on the basis of students' academic interests, professional foundation and achievements of specialized research. Xi'an Jiaotong University's comprehensive selection system of "two-stage and four-module" multi-element testing formed during the process of talent selection clearly contains assessment contents for students' mental and physical performances [1]. Wuhan University adopts the unique examination method of full open book, all weather, and all English when selecting talents, and focuses on the physical and mental health, effort level, study spirit, talent and potential of students in the later period [2]. In addition, Du Yubo proposed that when selecting top-notch innovative talents, focusing on various aspects of investigation, scientifically viewing "partial talents" and "geeks", and paying more attention to the scientific quality of students cannot be ignored [3].

##### 3.1.2. Selection mechanism

At present, the selection mechanism of top-notch innovative talents in Chinese colleges and universities can be roughly divided into two categories: one is the "strong selection" that focuses on the selection of students, starting with the excellent and selective examinations and comprehensive multi-faceted recognition of student talents; the other is "weak selection" that does not set a high threshold and selects while training [4]. Through summing up, it is concluded that a large proportion of colleges and universities in China adopt the "strong selection" model. For example, three universities including Nanjing University, Shanghai Jiaotong University and

Fudan University, on the basis of the second selection of freshmen, comprehensively use a certain proportion of enrolled students, interviews and direct selection to select and supplement talents [5]. In addition, the selection of talents can be further advanced to expand the scope of cooperation. For example, lots of universities have tried to cooperate with high schools to carry out research and experiments on the cultivation of innovative talents, which is an effective way for universities, scientific research institutions and middle schools to jointly discover and train young talents for scientific and technological innovation [3]. At the same time, colleges and universities also introduced dynamic management and a scientific elimination and diversion mechanism to unblock the channels for talent training and ensure the elite and sustainable training of the talent team.

### 3.2. Talent Characteristics and Growth Laws

The law of growth of top-notch innovative talents, that is, the general growth path shown by the interaction of its own characteristics and environmental conditions under certain social environmental conditions. By studying the characteristics of talents and the laws of talent development, it helps to more objectively and scientifically grasp the necessary stages of talent training and set up the training model.

#### 3.2.1. Talent characteristics

Chen Quan et al. summarized the qualities that top innovative talents should possess as a perfect personality, unique personality qualities, and high innovation literacy, emotional intelligence literacy, leadership and management literacy [6]. Zheng Youxun and others pointed out that the characteristics of talents should include strong interest and curiosity, a complete self-quality structure, good ability to resist stress and frustration, a strong sense of innovation and ability, and unremitting subjective efforts [7]. Zeng Qingyu and others introduced the concept of "adaptive expertise" consisting of factual knowledge, conceptual knowledge and transfer ability, and believed that the expertise has the dual identity of knowledge and innovation, which is qualitatively different from conventional expertise and can reflect the core qualities that top-notch innovation talents should possess [8]. Additionally, top-notch innovative talents may have different traits from ordinary people, and may even have "abnormal" traits. Yan Guangcai and others advocated understanding and respecting these qualities, resisting all kinds of stereotypes, reducing shackles and stereotypes, and accommodating their "oddities" [9].

#### 3.2.2. Growth law

Regarding how to analyze and refine the growth law of top-notch innovative talents, Xue Yongwu proposed that attribution theory and causal analysis, social investigation, quantitative and qualitative analysis, case studies and other methods should be used for research [10]. Lin Chongde and others analyzed the growth process of 34 top-notch innovative talents in natural sciences and 36 top-notch innovative talents in social sciences, and found that the growth of talents is consisted of five stages, which are self-exploration period, concentrated training period, talent display and field orientation period, creation period, post-creation period [11]. Zhang Xiaoyu analyzed the growth path of top-notch innovative talents represented by the State Preeminent Science and Technology Award winners, and obtained the following law of talent growth: cannot be separated from the support of social material civilization and spiritual civilization, high-level education, long-term accumulation, superior intelligence, life guidance and academic guidance of famous teachers [12].

### 3.3. Training Concepts and Modes

In recent years, the cultivation of top-notch innovative talents in China can be generally divided into: the establishment of independent colleges (such as Kuang Yaming College of Nanjing University, Wu Yuzhang College of Sichuan University), and the establishment of experimental classes (such as Nankai University, the University of Science and Technology of China), Single-column special programs (such as Wangdao Program of Fudan University, Top Student Training Test Program of Xiamen University), etc. As for the research on the concept and model of top-notch innovative talent cultivation, different colleges and universities have different goals and types of talent cultivation. In addition, the current talent cultivation is still in the exploratory and experimental stage, so a diversification of cultivation concepts and a differentiation of training models have been revealed.

#### 3.3.1. Training concepts

Regarding the concept of talent cultivation, Ye Fugui and others advocated the "student subject" theory, arguing that the cultivation of top-notch innovative talents should follow the basic rules of talent growth, take students as the main body, and give students the academic freedom and rights they deserve [13]. Gao Donglei put forward the "diversity" doctrine. When cultivating top-notch innovative talents, it is necessary to respect and give full play to the interests, specialties and hobbies of different types of students, and strive to adapt to the requirements of social development for

multiple types of senior talents [14]. Song Qiurong advocated creating a relaxed atmosphere, allowing students to have the leisure and interest to look up at the starry sky, the "peace of mind" and the lofty aspirations [15].

### 3.3.2. Training modes

Lin Chongde summarized the talent training mode in recent years into activity curriculum training mode, classroom teaching innovation mode, and joint training mode of colleges and high schools [11]. Song Qiurong proposed the cultivation mode of marriage of science and art, integration of general and professional, combination of China and the West, small classes and personalized training, in order to cultivate top-notch innovation talent with a balanced knowledge structure, profound knowledge and healthy personality characteristics [15]. By comparing and analyzing the training modes of 6 universities including Peking University, Nanjing University, and Xiamen University, Cui Jin summarized the common characteristics of the top-notch innovative talent training mode, which including the implementation of the undergraduate tutor system, the development of scientific research innovation training, the emphasis on creating an academic atmosphere, and focusing on cooperative training as well as students' comprehensive ability training [16].

According to how colleges and universities should choose the appropriate top-notch innovative talent training mode, from the perspective of training environment, Zhao Jushan and others took the knowledge field (the subject and multi-disciplinary) and the training environment (localization and internationalization) as the basis for dividing, constructed a two-dimensional model and analyzed the advantages and disadvantages of four different training types, which provide a reference for colleges to choose the type of training [17]. Lu Yi et al. believed that the cultivation mode was related to the selection method, and proposed three selection and cultivation modes: "strong selection-closed special zone type cultivation", "strong selection-semi-open double cultivation" and "weak selection-open barrier cultivation", and analyzed and summarized various advantages and disadvantages, implementation conditions, and applicabilities [4].

## 4. RESEARCH PROSPECT

### 4.1. Theoretical Research

It can be seen from the analysis of the research results of top-notch innovative talents in China in the past ten years that the current research content has covered many aspects of the cultivation of top-notch

innovative talents, but some problems are still needed to be focused on. Firstly, moral education research for top-notch innovative talents is insufficient. Secondly, there is a lack of research on the cultivation of top-notch innovative talents in the art field. Thirdly, less research on top-notch innovative talents' cultivation system and mechanism. Lastly, the research method is relatively simple. Most of the literature adopts a more macroscopic qualitative analysis method, and lacks empirical research.

It is necessary to continue to carry out more in-depth research in accordance with the traditional research direction when discussing the cultivation of top-notch innovative talents in the future, and make full use of the existing valuable research results. However, it is not enough to just refer to the existing research content, but also to make up for the shortcomings of the research status, and combine the particularity of the new era of talent training to focus on solving higher education problems. Therefore, it is suggested that the theoretical research on the cultivation of top-notch innovative talents in the future can focus on the following four aspects. First, the New Era Education Policy clearly states that in the direction of running a school, adhering to the direction of running a socialist school and implementing the fundamental task of establishing morals should be paid attention to. Therefore, colleges and universities should strengthen research on moral education and ideological and political education of top-notch innovative talents. Second, in order to achieve the fundamental goals which is put forward in the New Era Education Policy of cultivating new generations who are in charge of national rejuvenation and cultivating socialist builders and successors in the comprehensive development of morals, ethics, physical beauty and labour, future research should also focus on outstanding psychological characteristics and comprehensive qualities of top-notch innovative talents. Third, from the perspective of top-level design, study the cultivation system and mechanism of top-notch innovative talents. At last, the transition from theoretical to practical research in research methods should be focused on. It is recommended to do empirical research through questionnaires, interviews and other methods.

### 4.2. Practice and Exploration

In the actual process of exploring the cultivation of top-notch innovative talents, Chinese colleges and universities have accumulated a lot of experience and practice, and achieved certain practical results. While the practice intensity is still far behind that of foreign universities. It is recommended to strengthen practice intensity from the following three aspects. First, expand the scope of experimentation in the cultivation of top-notch innovative talents, and encourage qualified and capable institutions to learn from the



successful training modes and practical experience of foreign universities, such as the establishment of independent colleges, experimental classes, special programs, etc. Second, according to the New Era Education Policy and new era requirements, highlight the needs of the future socialist modernization, and focus on cultivating high-quality and professional innovative talents in the highly sophisticated fields on the basis of training innovative talents in basic disciplines. At last, actively establish a cooperative training mechanism for top-notch innovative talents with high schools, cultivate talents' scientific and technological innovation awareness and comprehensive quality ability in advance, enhance the pertinence of talent selection, and lay the foundation for the quality of top-notch innovative talents.

## 5. CONCLUSION

In the past ten years, with the vigorous promotion and support of the country, the academic community has actively explored and researched relevant issues in the cultivation of top-notch innovative talents. Universities have also dared to practice education and teaching reform measures. Both in theoretical research and practical exploration have accumulated a large number of research results and lessons. With the introduction of the "Strengthening Basic Disciplines Program" in 2020, the cultivation of top-notch innovative talents will remain an important issue that needs to continue to be explored and solved in the field of education in the future. Institutions should consciously conduct in-depth theoretical research and practice and exploration on the cultivation of top-notch innovative talents, and cultivate more top-notch innovative talents who are interested in serving the country's major strategic needs and have excellent comprehensive quality or outstanding in basic disciplines.

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