TRANSFORMAÇÃO
Revista de Filosofia da Unesp 50 anos

unesp UNIVERSIDADE ESTADUAL PAULISTA
"JÚLIO DE MESQUITA FILHO"
FACULDADE DE FILOSOFIA E CIÊNCIAS

Constructing the cognitive system of innovative talent behavior from the perspective of Qian Xuesen's Dacheng Aesthetic Thought

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LU, Peng. Constructing the cognitive system of innovative talent behavior from the perspective of Qian Xuesen's Dacheng Aesthetic Thought. *Trans/Form/Ação:* Unesp journal of philosophy, Marília, v. 47, n. 5, "Eastern thought 2", e02400251, 2024.

Abstract: The autonomous cultivation of high-caliber talents constitutes a critical focal point and fundamental basis for the successful execution of the "Talent-Driven Nation" strategy. Qian Xuesen's philosophical thought is epitomized by his Dacheng Aesthetics, representing the core content of Metasynthetic Wisdom. This research draws inspiration from the enlightening discourse on Qian Xuesen's Dacheng Aesthetics and aims to explore comprehensive approaches for the cognitive and behavioral cultivation of innovative talents. Through a meticulous examination of the elemental foundations underpinning the development of innovative capabilities in outstanding talents, this study proposes a sophisticated structural model conducive to China's distinctive knowledge systems and the cultivation of innovative thinking among exceptional individuals. Furthermore, this investigation puts forth strategic initiatives geared towards nurturing behavioral creativity and offers substantial recommendations and insightful perspectives aimed at optimizing contemporary university student training models and elevating the overall quality of talent development.

Keywords: The Dacheng Aesthetic. Innovative talents. Behavioral cognition.

SUN, Jie. Construção do sistema cognitivo de comportamento inovador de talento desde a perspectiva do pensamento estético Dacheng de Qian Xuesen. *Trans/form/ação:* revista de filosofia da Unesp, Marília, v. 47, n. 5, "Eastern thought 2", e02400251, 2024.

Resumo: A cultura autônoma de talentos de alto calibre constitui um ponto focal crítico e uma base fundamental para a execução bem-sucedida da estratégia "Nação Forçada de Talentos". O pensamento filosófico de Qian Xuesen é epitomizado por sua Estética Dacheng, representando o conteúdo central da Saúde Metassintética. Esta pesquisa traz inspiração do discurso iluminante sobre a Estética Dacheng de Qian Xuesen e visa a explorar abordagens abrangentes para a cultura cognitiva e comportamental de talentos inovadores. Através de um exame meticuloso das fundações elementais, as quais sustentam o desenvolvimento de capacidades inovadoras em talentos excelentes, este estudo propõe um modelo estrutural sofisticado que favoreça os sistemas de conhecimento distintos da China e a cultivação de pensamento inovador, entre indivíduos excepcionais. Além disso, esta investigação apresenta iniciativas estratégicas voltadas para fomentar a criatividade comportamental e oferece recomendações substanciais e perspectivas inteligentes, almejando otimizar modelos contemporâneos de treinamento universitário e elevar a qualidade geral do desenvolvimento de talentos.

Palavras-chave: A Estética Dacheng. Talentos inovadores. Cognição comportamental.

Received: 10/05/2024 | Approved: 02/07/2024 | Published: 23/08/2024
https://doi.org/10.1590/0101-3173.2024.v47.n5.e02400251

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Introduction

Qian Xuesen's thought is rooted in Marxist philosophy, integrating science with philosophy, thereby enriching the scientific connotation of Marxist philosophy. On the basis of the complementary and fusion of Eastern and Western cultures, Qian Xuesen scientifically demonstrated and profoundly expounded upon Engels' foresight regarding the development of natural science into "[…] a magnificent science of interconnectedness" (Qian *et al.*, 1990, p. 3). Qian Xuesen incorporated the theory of complex mega-systems into the realm of aesthetics, constructing an integrated aesthetics framework centered around quantitative aspects. The paper uses Qian Xuesen's aesthetic theories as its foundation, primarily employing his complexity research and quantitative combination methods. It aims to explore innovative models for the autonomous cultivation of top-tier creative talents within the context of contemporary technological development. By integrating talent development with innovative cognitive abilities, the study applies Qian Xuesen's "Dacheng Aesthetics" theories and methodologies to analyze three key aspects: the construction of knowledge systems, the

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establishment of innovative thinking and the activities of cognitive behavior. Additionally, it examines new models for the education and cultivation of innovative talents through the practical outcomes of pilot reform initiatives.

1 Related work

What does "Dacheng" mean? According to the explanation in *Ci Hai* (a Chinese dictionary): it refers to significant accomplishments and completeness, with the former being more decisive. The main manifestations are found in three aspects: achievements, knowledge and morality. These ideas have their roots in the Confucian tradition that emphasizes the cultivation of virtues, accomplishments and discourse.

The conditions, means and cultural atmosphere that foster the achievement of Dacheng vary across different eras, inevitably giving rise to different tastes of culmination (Wang, 2018, p. 114). In the 21st century, the pinnacle of accomplishment lies in the integration of humans and machines. Those who dare to venture, shoulder responsibilities, excel in practical endeavors, possess enriched knowledge reservoirs and understand the importance of considering the broader context become the purveyors of culmination in the present and the future.

Instead, the Dacheng Aesthetic Thought is rooted in the intelligence of integration, drawing on the complementary and blended elements of Eastern and Western cultures. It combines "quality intelligence" and "quantity intelligence" in a philosophical manner. The Dacheng Aesthetic Thought emphasizes both scientific rigor and the study of human beings. It explores both linear and nonlinear research approaches, rationality and non-rationality, logical thinking and intuitive understanding. It values holistic perspectives as well as analytical reductionism. It respects the inheritance of classical aesthetic traditions while also focusing on the study of the modern characteristics of aesthetics — a "synthesis" philosophy that integrates these diverse aspects.

2 The construction of Dacheng Aesthetic Thought

2.1 The integration of quantity and quality as the core content of Dacheng Aesthetic

Qian Xuesen divided knowledge into two major parts: "quantity intelligence" and "quality intelligence", and introduced them into modern scientific thinking.

> The knowledge that focuses on exploring the essence and laws of intelligence from the micro to the macro, from quantitative change to qualitative change, from the local to the whole development process is referred to as "quantity intelligence". The knowledge that focuses on perceiving the essence and laws of things from the macro

> to the micro, from the whole to the parts and from the perception of the images of things is referred to as "quality intelligence" (Wang, 2001, p. 361).

Qian Xuesen viewed the relationship between art and science from a holistic, dynamic, systematic, developmental and ever-changing perspective. This approach breaks through the millennium-old barrier between scientific culture and humanistic culture, emphasizing the connection between the "quantity intelligence" and the "quality intelligence". Through practical experiential knowledge, philosophical thinking and the experience of practice, science and art are interconnected.

Each discipline, within the realm of artistic sciences, has its own branch of aesthetics as guidance, with aesthetics serving as the "bridge" to Marxist philosophy (Qian, 2009, p. 35). The elevation of artistic practice to Marxist philosophy necessitates a comprehensive process, namely, the practice of literary arts → branch aesthetics → general aesthetics → Marxist philosophy, which corresponds to the progression from the specific to the general understanding of principles and laws. Conversely, it involves utilizing a general understanding of principles and laws to guide individual research. For example, in the realm of figurative arts, the refinement of artistry ascends to the level of figurative aesthetics. Figurative aesthetics, alongside other branch aesthetics, possesses features of general aesthetics, and its expression of philosophical insights and worldview serves as a bridge to Marxist philosophy.

2.2 The important method of integrating qualitative and quantitative aspects in the Dacheng Aesthetic Thought

In his book *Art and Aesthetics in Modern Science*, Qian Xuesen embarked on exploratory research into the realm of art and aesthetics, using systemic theory, information theory, control theory and fuzzy thinking. This reflects the latest trends, in the field of aesthetics, amidst the wave of new technological revolutions. By employing an integrated approach that spans from qualitative to quantitative aspects, he integrated thinking, intelligence, science and technology, forming an intelligent system that combines human and machine. Through the progression from qualitative to quantitative (from sensory to rational) and, then, to practical approaches, complex problems are addressed.

The process of integrating qualitative and quantitative aspects forms a dynamic network system that constitutes a more complete methodological framework. "Cognition is the eternal and endless approximation of the subject by thinking", and "[…] human cognition is not a straight line but an infinite approximation to a series of circles, resembling a spiral curve", as stated by Lenin (Lenin, 1990, p. 201). The process of integrating qualitative and quantitative aspects provides a dialectical and scientific approach to realizing this "circle" of

understanding. By applying this scientific method, one can continuously grasp the essence and laws of the process of cognition by achieving a series of "circles" in understanding, forming a spiral-like curve.

2.3 The theory of open complex giant systems as the foundation of the Dacheng Aesthetic Thought

According to Qian Xuesen, "[c]omplexity refers to the dynamics of an open complex giant system, or the study of an open complex giant system" (Xun; Deng, 2001, p. 199). Qian Xuesen defines complex systems as giant systems, characterized by vast scale, dynamic openness and hierarchical stratification. The concept of the "open complex giant system" is central to the science of complex systems. The integrated approach from qualitative to quantitative methods is the correct way to understand and address open complex giant systems. Applying the study of complexity science to aesthetics is an important aspect of Qian Xuesen's approach in constructing the Dacheng Aesthetic Thought.

From a theoretical perspective, Qian Xuesen viewed beauty and artistic phenomena through a systemic lens and considers aesthetic perception and artistic appreciation as processes of information transmission and reception. With a fresh perspective and scientific methods and means, he sought to reveal and illuminate the essence of beauty.

Methodologically, Qian Xuesen applied the approach for resolving complex giant systems to address aesthetic problems. He believed that art itself belongs to an open complex giant system. It is a human-made system, a conceptual system, a dynamic system, an open system and, at the same time, a behavioral one. Placing art within cultural or other systems, it becomes merely a subsystem. However, as artistic creation, artistic appreciation and artistic criticism—the constituent parts of the art system — they become independent subsystems. Therefore, beauty itself is an open complex giant system.

The Dacheng Aesthetic Thought addresses issues, such as the position of aesthetics, within the modern scientific system, and the parallel relationships among various artistic disciplines. It proposes the establishment of a "network connection" model and constructs "network connection relationships" among different disciplines (Baltes; Staudinger, 1993, p. 75). Painting can form various combinations not only with poetry, but also with other art forms, such as theater and film, giving rise to unique unions. As an integrated artistic system, it emphasizes not only the cohesion and harmony among its various components, but also the diversity that exists among different artistic genres. This is because it is through these differences that mutual existence and development can occur. By integrating the "top-down" approach of traditional philosophy and the "bottom-up" one of modern aesthetics, the Dacheng Aesthetic Thought emphasizes the multidirectionality of its research direction.

3 Innovation of the Dacheng Aesthetic Thought

3.1 Methodological innovation

The metha-synthesis method is the primary approach in the study of Dacheng Aesthetics. Qian Xuesen, as early as the 1980s, indicated that "[…] what is referred to as complexity is actually the dynamics of open complex mega-systems", and also pointed out that "[…] complexity is a characteristic of open complex mega-systems". Qian Xuesen categorized everything as a system, distinguishing among simple systems, simple mega-systems, complex mega-systems and special complex mega-systems. Open mega-systems, such as the human body, the human brain, geography and society, belong to the category of special complex mega-systems. Each object constitutes a new scientific research field in the macro world, engaging in the exchange of information and matter with the external environment. Dacheng Aesthetics utilizes the methodology of complex systems research to define holistic objectives, elements, levels, and the interconnections and influences among each level.

The Dacheng Aesthetic Thought is founded on the concept of wholeness. In its research, it applies holistic thinking. On one hand, it investigates the aesthetics of individual disciplines, exploring their unique characteristics, essence and aesthetic aspects. On the other hand, it studies the entirety of aesthetics, examining the interactions, influences and transformations among different artistic disciplines. By establishing models and frameworks that depict the interconnectedness among various artistic domains, it constructs a comprehensive system to investigate the interplay, interactions and mutually enhancing relationships between aesthetics and other scientific disciplines. It comprehensively grasps the entirety of the modern scientific and technological system.

The integration of quantitative approaches is a distinctive research method in the study of Dacheng Aesthetics. The mete-synthesis method that combines qualitative and quantitative approaches is an important research method in the Dacheng Aesthetic Thought. The transition from qualitative to quantitative scientific integration is the correct approach to understanding open, complex and large-scale systems. Qualitative and quantitative aspects are dialectically related in this process, with the ultimate focus falling on quantitative analysis. From a qualitative perspective, it then ascends to a higher level of qualitative analysis through a quantitative lens. According to Dacheng Aesthetic Thought, the essence of aesthetics lies in the transmission of information, specifically aimed at conveying aesthetic experiences. When facing issues in open, complex and large-scale systems, it advocates the integration of human and machine, taking humans as the primary focus. By combining human "mind" with the high-performance information processing of computers, it achieves a synthesis of qualitative and quantitative approaches, complementing and enhancing research in the field of arts and literature system engineering.

3.2 Innovation in content

Aesthetic research from diverse perspectives and viewpoints is an integral component of Dacheng Aesthetics. After Qian Xuesen introduced the scientific field of "open complex giant systems" and its fundamental principles to the world, it was recognized that complex systems are nearly ubiquitous. Furthermore, it was acknowledged that aesthetics belongs to the realm of complex systems, simultaneously existing and influencing various aspects of human cognition, knowledge, behavior and thinking. Dacheng Aesthetics places great emphasis on the philosophical and cognitive perspectives of beauty. It views aesthetics as a bridge connecting literature, art and Marxist philosophy. Qian Xuesen advocated that "[…] aesthetics primarily belongs to philosophy, so aesthetics must conform to the philosophical principles of modern science, technology, and objective understanding of the world, namely Marxist philosophy and dialectical materialism" (Qian, 2007, p. 348). Dacheng Aesthetics highlights the integration of insights from cognitive science and human physiology, incorporating studies from psychology and ergonomics to enrich the understanding of aesthetics.

The essence of literature and art lies in the artistic processing, dispersion, reconfiguration and reconstruction of sensory materials. Particularly, research on empirical thinking, inspirational thinking and innovative one provides strong support for scientifically comprehending and studying aesthetics. Dacheng Aesthetics focuses on the study of beauty from both the artistic and scientific perspectives. It places art within the framework of modern science, emphasizing that art falls under the direct governance of science and is influenced by other scientific disciplines. Furthermore, it acknowledges the impact of scientific and technological advancements on art, both in terms of advancement and limitations. This highlights Qian Xuesen's belief that aesthetics encompasses both the realm of art and the realm of science.

Dacheng Aesthetics emphasizes the sociological perspective in the study of beauty. It maintains that the perception and aesthetic capacity of beauty vary greatly and are influenced by one's social status. The distinction between civilization and barbarism lies in the concepts of beauty and ugliness. What is deemed beautiful is associated with civilization, while what is considered ugly is associated with barbarism. The pursuit of beauty, in various aspects of life, is an expression of socialist material and spiritual civilization. The subjective practice of aesthetics is formed within the context of one's life and social influences. As individuals engage in different social practices, their sense of beauty also varies. In other words, "[…] there is no so-called beauty detached from social practice" (Yang, 2020, p. 67).

Building upon the foundation of traditional Chinese philosophy that emphasizes the harmony between nature and humanity, Qian Xuesen fused the artistic concepts of landscape poetry, garden architecture and landscape painting to propose a vision for future cities in

China. "The ancient Chinese culture of landscape painting embodies an 'otherworldly' essence, while our 'landscape cities' embrace an 'in-worldly' character" (Qian, 2010, p. 11). The concept of a landscape city aims to immerse every citizen in a garden-like environment, making it accessible to the general public. It represents an "in-worldly" manifestation. At the heart of the poetic and picturesque is the expression of artistic conception, where the ultimate realm of a landscape city lies in the beauty of artistic conception.

The study of transformative interplay between science and art is of paramount importance. Qian Xuesen stated,

> The development of science and technology provides various tools for artistic expression. Without film technology, there would be no film art; without photography technology, there would be no photography art; and without the advancement of electronic technology, television would not exist as a means of artistic expression (Qian, 2009, p. 253).

Qian Xuesen emphasized that completely severing technology from art and fine arts is incorrect and goes against the history of human development (Qian, 2009, p. 28). Qian Xuesen advocated for the establishment of a unique Chinese art form called "Ling Xiang" (spiritual imagery) art, which combines art with technology and technology with fine arts, blending artistic concepts with a spiritual realm. According to Qian Xuesen, the highest standard of aesthetic beauty in technology is the "existence of life". Technological aesthetics is purposeful and utilitarian, characterized by exemplars and rules.

New technologies have provided a more comprehensive, precise and systematic means of observing objective phenomena. The application of these technologies has brought forth a new way of perceiving the world, greatly enriching the expressive potential of modern art. Modern internet technologies have also introduced new channels and modes of dissemination for art, offering unprecedented interactive visual experiences, digital museums and immersive interactive encounters, unifying authenticity and virtuality. The integration of augmented reality, virtual reality, mixed reality, 3D printing, holographic imaging, brain-computer interface technology and sensor technology, among other digital interactive technologies, has injected new vitality into artists' creative inspiration, while also presenting a broader platform for artistic dissemination and communication.

4 Influence of Qian Xuesen's Dacheng Aesthetics on the construction of cognitive system for innovative talents

4.1 The holistic construction of the knowledge structure of innovative talents

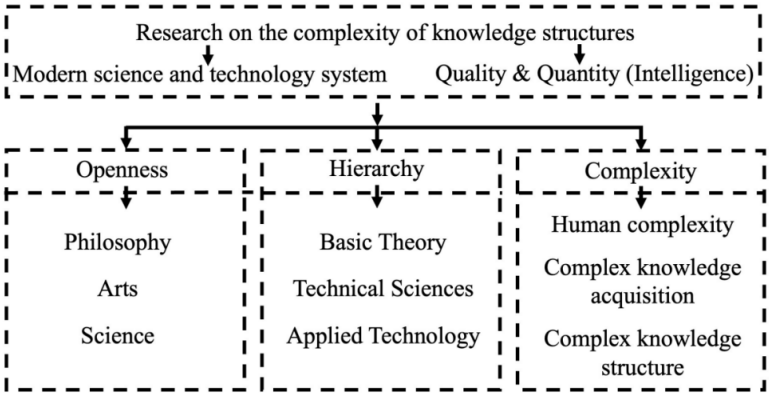
Generally speaking, the more knowledge one possesses, the greater potential for wisdom. But wisdom cannot simply be considered as the accumulation of extensive knowledge. The founders of intelligence tests, Binet and Simon, believed that memory is not a crucial aspect of wisdom. Heraclitus also believed that being knowledgeable does not necessarily equate to wisdom. Additionally, educational psychology has discovered that the subjective value of exceptional and innovative talents primarily lies in the development of their own psychological attributes and the demand for subject-specific knowledge, which are key factors influencing their cultivation (Yan, 2018, p. 63). Enriching one's breadth of knowledge and fostering creative abilities serve as direct driving forces for enhancing innovative capabilities (Li *et al.*, 2022, p. 53).

According to Qian Xuesen, the core of educating top talents does not lie solely in identifying individuals with exceptional abilities. Qian Xuesen's Aesthetic Thought helps us fully understand the complexity, dynamism and systemic nature of cultivating top talents. The students' abilities, interests and strengths, as well as the constant changes in society, science and technology, and cultural ideologies, should be comprehensively and systematically considered and analyzed. Therefore, talent development is a systematic endeavor that must adhere to the laws governing talent development, while maintaining stability, coherence and universality in cultivating top talents (Din *et al.*, 2016, p. 117).

Modern education excessively emphasizes rationality, often neglecting the holistic development of students' personalities. The emphasis is placed too heavily on the quantity and precision of skill mastery while disregarding the profound cultivation of aesthetic education. Uniform educational models have the potential to stifle the college students' individual development. Utilitarian education overlooks those experiences that cannot be easily operationalized or made practical, causing students to lose out on transcendent qualities.

Under the guidance of the modern scientific and technological system, the open complex mega-system, and the theory of quality and quantity intelligence, there is an analysis of the openness, hierarchy and complexity of the knowledge system for cultivating top talents. Openness emphasizes the cultivation of both quality and quantity intelligence in top talents, with a focus on fostering scientific, technological, philosophical and artistic literacy. Through the spiral advancement of the "Science-Art Environment", wisdom can be obtained. Hierarchy refers to the classification of knowledge levels in the process of cultivating the knowledge of top talent. The hierarchical levels of knowledge have complex interconnected relationships (Piaget, 1992, p. 126), which maintain and process the intricate internal connections, forming a unified, robust and dynamic whole (see Figure 1).

Figure 1 – Knowledge system construction model



Source: The construction of the knowledge system based on the Dacheng Aesthetic Thought

Since the admission of the first Qian Xuesen Experimental Class in 2007, Xi'an Jiaotong University has been following Qian Xuesen's educational philosophy of "achieving wisdom through integration" to explore a new model for education and the cultivation of outstanding scientific and technological talents, in line with the needs of societal development.

The Qian Xuesen Experimental Class follows a "2+4+X" model. This includes two to two and a half years of integrated general engineering education covering physics, mechanics, dynamics and electronics. It, then, progresses to one and a half to two years of specialized education, two years of master's research training and X years of doctoral innovation training. The undergraduate program of the Qian Xuesen Experimental Class adopts a curriculum that combines quantity intelligence with quality one, science with art, science with philosophy, logical thinking with visual one, and micro-level understanding with macro-level one. It integrates various types of courses, including specialized courses, fundamental courses and laboratory ones. The teaching is combined with scientific research, independent learning, innovative one and research practice. It incorporates new trends and technologies in the development of disciplines and fully reflects the integration of science, engineering, and humanities in the design of the curriculum system and training process. It breaks through the barriers between different scientific and technological disciplines, allowing students to develop the ability to make connections across domains, solve complex problems from a systematic perspective and develop a holistic understanding of the world. Through this approach, students can comprehend and master the theories and laws of science and technology.

4.2 The construction of the innovative thinking model for innovative talents

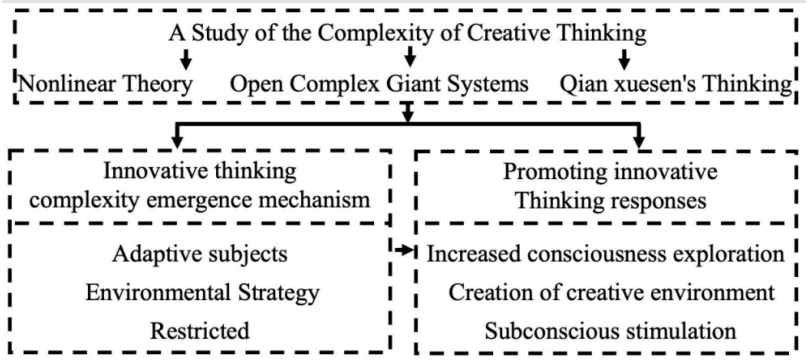
According to Guilford, creativity encompasses both creative thinking and creative personality. The primary manifestation of creative thinking is divergent thinking (Lin, 2015, p. 577). Piaget focused on intelligence in his research, striving to explore the structure and age-related functions of intelligence. Piaget believed that the fundamental form of intellectual development is a spiral of ascending processes, leading to the formation of distinctive psychological structures through equilibration, automatic adjustment, new equilibrium, new mediation, and so on, in a spiral-like progression. "Operations" serve to demonstrate the external manifestations of intellectual development (Piaget, 1992, p. 126).

In the exploration of aesthetics, particularly in the study of human cognitive activities, Qian Xuesen argued that human thinking is a nonlinear kinematic process. The Dacheng Aesthetics not only emphasizes the study of the essence of beauty through logical thinking, but also focuses on non-logical thinking. It regards imaginative thinking as one of the fundamental modes of human thinking, as it is the crystallization of conscious and subconscious interactions, the core of creative thinking, and the wellspring of scientific research and artistic creation.

Qian Xuesen's originality, in the field of cognitive science, lies in his use of a holistic perspective to analyze human thinking issues and his integration of new achievements in modern science and technology, which marked the first scientific, holistic and systematic analysis of modern cognitive science.

Human cognition exhibits typical characteristics of complexity science (Favela, 2020, p. 1). Building upon Qian Xuesen's series of theories in cognitive science and adopting a perspective rooted in complexity research, the construction of an innovative thinking model is approached from a cognitive standpoint, clarifying the context of innovative thinking and optimizing the pathways of it. From the perspective of the emergence theory of complexity science and by leveraging the mechanisms of creative thinking emergence, the conditions and traits that "generate" and "constrain" creative thinking are analyzed. Through the dual dimensions of the cognitive subject and object, subconscious thinking is stimulated, exploratory abilities are enhanced and the mechanisms for constructing creative thinking are established, which, to a certain extent, enriches the avenues for realizing creative thinking (Guo; Wang, 2019, p. 21) (see Figure 2).

Figure 2 – Innovative thinking patterns



Source: The innovative thinking cultivation mode based on Dacheng Aesthetic Thought

The Qian Xuesen Class, at Xi'an Jiaotong University, places significant emphasis on nurturing innovative thinking among its students.

Firstly, it fosters an environment that encourages students to engage in bold exploration, innovative initiatives and daring forays, unconstrained by reliance solely on textbooks, a quest for singular solutions or deference to unchallenged authority. Within the pedagogical sphere, it underscores the cultivation of a diverse array of talents, prioritizing the pursuit of originality. This effort supports students in transcending conventional modes of thinking, steering clear of undue deference to authority and the allure of conformity, championing, instead, the courage to take risks and pioneer new approaches. It advocates for deliberate diversity, eschewing uniformity, and encourages the exploration of multiple solutions for a single question, as well as the generation of varied perspectives on a singular matter.

Secondly, this endeavor is complemented by a robust foundation of practical experience that serves as the crucible for innovative thinking training. This approach advocates for a problem-oriented pedagogy, underscores direct engagement with reality, and fosters the ability to identify and analyze issues, propose hypothetic frameworks, validate assumptions and derive conclusive outcomes. Through this approach, students cultivate a keen interest in scientific research, actively participate in research competitions and achieve commendable outcomes.

Finally, the Qian Xuesen Class aligns with the principles of objective scientific thinking, ensuring that reverse thinking is balanced and rational, and that forward-thinking emphasizes thorough investigation and research pursuits. It also upholds the ethical and value boundaries of science and technology, maintaining a foundational threshold of thought, strengthening political and ethical guidance, and fortifying the nurturing of explorative and innovative thinking qualities among its student cohort.

4.3 The construction of the cognitive behavioral activity model for innovative talents

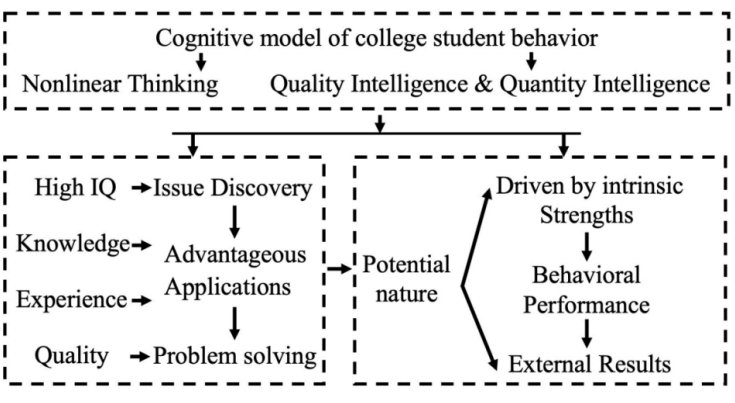
In the 1980s, the Berlin Institute for Human Development and Education in Germany, represented by Baltes, conducted research on the Berlin Wisdom Paradigm. It posited that wisdom is a system of expert knowledge and behavior, encompassing exceptional intuitive judgments and advice regarding complex and uncertain human life situations. Wisdom is considered to comprise five aspects of knowledge: factual knowledge about basic life, strategic knowledge about basic life, knowledge of social life changes, knowledge of values and knowledge of uncertainty.

The Berlin Wisdom Paradigm divides "cognition" into cognitive mechanisms and cognitively related knowledge. Cognitive mechanisms primarily refer to aspects, such as neuronal and physiological structures resembling the brain, while cognitively related knowledge pertains to knowledge about individuals, society and culture. According to the Berlin Wisdom Paradigm, wisdom is closely linked to experience and cognitively related knowledge. Therefore, the Berlin Wisdom Paradigm essentially equates "wisdom" with "knowledge". However, in essence, "knowledge" and "wisdom" differ significantly, and they cannot be considered equivalent (Zhang *et al.*, 2023, p. 721).

Cognitive ability, commonly referred to as "IQ", is the result of the combined effects of various capability elements possessed by the behavioral agents. The behavioral activities rely on the integrated effects of a series of capability elements possessed by them. These capability elements include both general intellectual abilities and practical behavioral ones related to innovation. By analyzing the driving role of a series of cognitive capability elements in innovation realization, the universal latent characteristics of innovative talents and the relationship between behavioral performance and external environmental conditions, as well as internal advantages, are studied. The cultivation of innovative behaviors, among top talents, involves nonlinear thinking and is guided by the theories of quality intelligence and quantity one.

By harnessing the synergistic effects of a range of elements encompassing general intelligence, abilities, experiences and qualities possessed by individuals, including practical behavioral capabilities associated with innovation, the primary objective is pursued. Through an analysis of the driving role that a series of cognitive elements of behavioral capabilities plays in innovation realization, the universal underlying characteristics of outstanding innovative talents are explored. Furthermore, the relationship between behavioral performance and external environmental conditions, as well as internal advantages, is investigated (see Figure 3).

Figure 3 – Cognitive model



Source: Cultivation of behavioral cognition based on quality and quantity intelligence

The Qian Xuesen Class, at Xi'an Jiaotong University, is dedicated to cultivating innovative talents. It aims to streamline the relationships among different modules of courses and optimize the logical connections within the knowledge structure across courses. Creating an environment that fosters innovation, collaboration and healthy competition, the class employs progressive teaching approaches, such as heuristic learning, inquiry-based learning, discussion-based learning and questioning-based one. By integrating learning and critical thinking, the emphasis is placed on developing both linear and non-linear thinking abilities, stimulating students' interests and nurturing their innovative thinking. Emphasizing the integration of knowledge and action, the cultivation of students' abilities to identify and solve problems is emphasized. The project-based training model provides students with opportunities to continuously face and solve problems, tailoring education to individual needs and advocating a unique training model characterized by "[…] personalized mentoring, individualized instruction, small class sizes, and internationalization" (Zhang; Yu, 2017, p. 71). "High-level major scientific research projects, high-level national-level experimental platforms, and high-level mentoring teams" serve as the three criteria to support scientific research.

The exploration of educational models for cultivating innovative talents is a long and arduous journey. It emphasizes the practicality, operability, universality, individuality and holistic development of talent cultivation, actively seeking breakthroughs in nurturing top-tier innovative talents in our country.

Conclusion

This study uses Qian Xuesen's "Dacheng Aesthetics" as a starting point to explore the outstanding natural scientists' philosophical thoughts and to research the framework and ideas for cultivating top-tier innovative talent autonomously.

The first focus is a systematic study of scientists' philosophical thoughts, especially in the context of the rapid development of modern digital science, emphasizing the holistic, complex, scientific, nonlinear and interdisciplinary nature of Dacheng Aesthetics.

The second focus is to explore the growth patterns of top-tier innovative talents, deriving strategies and methods for fostering and creating an innovative environment. Through a "quantitative and qualitative combination" approach, this research emphasizes the holistic, complex and nonlinear nature of education, advocating for an integrated method combining "knowledge, thinking, and behavior". It upholds a student-centered and practice-oriented philosophy, stressing the integration of interdisciplinary courses in philosophy, art and science, and aims to establish a multi-level and progressive system of innovative practical teaching.

The third focus is to implement theory into practice by integrating Qian Xuesen's "Dacheng Aesthetics" into the entire process of talent cultivation. It aligns with the goals and principles of cultivating top innovative talents, further refining the system and measures of talent cultivation, and continuously improving the quality and effectiveness of talent development. The cultivation of top talents in universities is a systematic process that requires continuous exploration and practice, based on serving national strategies, regional economies and industries.

This study integrates quantitative and qualitative intelligence to construct a competency model for innovative talent. It aims to address the limitations of Chinese education in knowledge, thinking and skills by examining the essence of innovative talent and proposing new ideas and perspectives. These efforts seek to optimize the talent cultivation model, providing practical references for the deepening reform of these models, improving teaching quality and enhancing the quality of talent development to promote the realization of the national talent strategy.

Future research should aim to elevate public awareness of the national strategic significance of talent cultivation, fostering a supportive social environment. Additionally, it should strongly support educators and professional management personnel, laying a solid foundation for "comprehensively improving the quality of talent cultivation and focusing on creating top-tier innovative talents".

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