

# Research on the Integration and Symbiotic Model of Foundational Design Education and Technology

Shuwen Zhang<sup>1</sup> Xinrong Zhang<sup>2</sup>

<sup>1,2</sup> School of Design, Central Academy of Fine Arts, Beijing 100105, China

<sup>2</sup> Corresponding author. Email: zhangxinrong@cafa.edu.cn

## ABSTRACT

The rapid development of modern technology, especially the widespread adoption of information technology and multimedia technology, has provided new tools and platforms for design education, breaking the limitations of traditional media and methods. In this context, foundational design education actively adapts to the profound changes brought about by the technological revolution in human production and lifestyles, embracing the future with innovative ideas and approaches. This article explores how, in the process of integrating advanced scientific and technological advancements into foundational art and design education, four important integrations can be achieved: the integration of art and science, accommodating both artistic and scientific thinking; the integration of past and present, combining traditional culture with modern technological innovations; the integration of green principles, promoting the symbiosis of natural ecology and scientific technology; and the integration without boundaries, fostering the organic combination of interdisciplinary elements. Through these integrations, design education not only enhances teaching quality and innovation capacity but also lays a solid foundation for cultivating well-rounded design talents who can meet the demands of future society.

**Keywords:** Foundational design education, Art and technology, Innovative integration.

## 1. INTRODUCTION

The development of fundamental design education aims to cultivate well-rounded, innovative talents, enabling students to solve complex problems, possess interdisciplinary comprehensive qualities, and have a strong sense of social responsibility. Achieving this goal relies on four integrations: the fusion of arts and sciences, the blending of ancient and modern, the harmonious coexistence with the environment, and the interdisciplinary integration. Firstly, artistic thinking and scientific thinking form the foundation of design thinking. This fusion allows students to propose creative design concepts and verify and realize these ideas through scientific methods, ensuring the innovation and practicality of the designs. Secondly, blending ancient and modern involves the integration of traditional culture and modern technological innovation. The integration of traditional and modern thinking enhances the depth and breadth of design. By preserving cultural uniqueness and incorporating forward-looking modern elements, students can promote the

inheritance and innovation of design. Next, the symbiotic relationship between natural ecology and scientific technology is indispensable in design. This combination cultivates students' environmental awareness and technical application abilities, enabling them to draw inspiration from nature and achieve sustainable development through technological means. Lastly, the interdisciplinary integration closely links the aforementioned elements, promoting students' ability to understand and solve problems from multiple perspectives. This nurtures comprehensive thinking and innovation, adapting to the complex demands of modern society. Through the progressive integration of these elements, fundamental design education can comprehensively enhance students' innovation abilities, comprehensive qualities, and social responsibility, enabling them to confidently tackle various complex challenges in future design practices and infuse new vitality and hope into social development and environmental protection.

## **2. INTEGRATION OF ARTS AND SCIENCES: UNIFYING ARTISTIC AND SCIENTIFIC THINKING**

The core of design education is to stimulate students' creative thinking. Creative thinking is precisely the fusion and complementation of artistic and scientific thinking. Artistic thinking represents inspiration and insight, emphasizing creativity and imagination. It can break conventions and see problems from a fresh perspective, inspiring unique ideas and concepts. Scientific thinking, on the other hand, represents logic and empiricism, focusing on rigorous analysis and experimental evidence. It systematically processes and handles sensory materials, solving problems through rational reasoning and verification.

Historically, art design and science and technology have been inseparable. In ancient times, designers were both artists and engineers, handling everything from design conception to production. Zhang Heng's seismoscope and armillary sphere were scientific instruments embodying aesthetics. The pyramids, the Parthenon, and Gothic architecture are exemplary works of great artists and the pinnacle of contemporary technology. Today, we have entered the digital age, where new scientific technologies provide broader foundations for artistic design activities. The widespread use of the internet, the development of digital manufacturing technologies, advances in nanotechnology, innovations in biotechnology, and the application of augmented and virtual reality technologies continually transform into new art design languages. These emerging technologies expand designers' creative means and expression forms, injecting new vitality and possibilities into art design.

In the history of science, many seemingly whimsical ideas have often led to significant leaps in scientific development. A famous example is Albert Einstein's theory of relativity. In the early 20th century, classical mechanics and electromagnetism could not explain certain phenomena. Einstein boldly hypothesized that the speed of light in a vacuum is constant and independent of the observer's motion, proposing special relativity, which revealed that time and space are interdependent and vary with the state of motion. This novel theory explained many experimental phenomena and predicted time dilation and length contraction effects. General relativity further revealed that gravity results from

the curvature of spacetime. These theories fundamentally changed humanity's understanding of the universe and became the cornerstone of modern physics. Another example is Alexander Fleming's discovery of penicillin. In 1928, Fleming noticed that a contaminated petri dish had mold that killed surrounding bacteria. Though initially seen as accidental and unimportant, Fleming's keen observation and bold hypothesis proposed that mold produced a bactericidal substance, eventually confirming the existence of penicillin. This discovery initiated the antibiotic era, significantly altering medical history and saving countless lives. Einstein and Fleming's successes stemmed not only from a deep understanding of existing knowledge but also from challenging traditional ideas and proposing new theoretical frameworks. It was a result of the mutual stimulation and complementation of scientific and artistic thinking. Whether exploring the universe or studying molecules, innovative thinking is the source and driving force of scientific development.

Design innovation thinking is essentially the collision and sublimation of artistic and scientific thinking into inspirational thinking. Contemporary basic education in art design should explore new talent cultivation models within the interplay of artistic and scientific thinking. Artistic thinking provides endless creativity and aesthetic value, enabling students to break conventions and propose unique design concepts. Scientific thinking ensures the feasibility and practicality of these ideas through precise calculations and experiments. By combining artistic inspiration with scientific rationality, students can maintain innovation while ensuring the feasibility and effectiveness of design solutions.

## **3. BLENDING ANCIENT AND MODERN: TRADITIONAL CULTURE PENETRATING MODERN TECHNOLOGY**

President Xi Jinping has pointed out that cultural prosperity leads to national prosperity, and cultural strength leads to national strength. Without high cultural confidence, there can be no cultural prosperity, let alone the great rejuvenation of the nation. The innovation in fundamental education in art design should not be a tree without roots or water without a source. It should inherit Chinese culture, root in the fertile soil of Chinese culture, and emerge in response to the practical needs of the new era. Based on culture, drawing from life, using

art as a carrier, and technology as a means, it promotes interdisciplinary integration and innovative development.

Leading design countries integrate traditional culture and scientific technology to lead global trends. Notably, in inheriting traditional culture, they are not bound by traditional symbols but integrate national culture and traditional crafts into modern design as an invisible metaphor and inner essence. Scandinavian styles typically integrate national traditions into modern design, rich in human touch, national character, natural beauty, simplicity, and modern beauty. For example, Finnish designer Alvar Aalto's glass vases, with organic shapes reminiscent of Finnish lakes, blend modernity with national sentiment, appearing natural and intimate. Japanese design reveals an aesthetic of "mono no aware," "yūgen," and "wabi-sabi." For instance, Sori Yanagi's butterfly chair combines traditional simplicity with advanced technology, showing Japan's emphasis on retaining national tradition while absorbing international influences. Italy combines the essence of Renaissance art with modern technology, evident in Cassina's furniture designs and Ferrari's car designs. Germany combines traditional craftsmanship with advanced engineering, with Bosch and BMW enjoying global acclaim.

In recent years, China has emerged in global design by combining Chinese traditional cultural elements with modern technology, showcasing exceptional innovation capabilities and profound cultural heritage. Huawei, as a leading Chinese tech company, continually breaks through in technological innovation and integrates rich Chinese cultural elements into its product designs. For example, the design inspiration for Huawei's Mate series smartphones comes from traditional Chinese minimalist aesthetics and natural elements. The curved design and color choices reflect a blend of elegance and modernity, with interface designs incorporating traditional arts like calligraphy and Chinese painting, creating a strong cultural ambiance for users. Additionally, the Forbidden City creative products develop a series of stationery, home goods, and clothing accessories, closely combining Chinese traditional culture with modern life needs. Products themed on Forbidden City architecture and ancient royal life, such as phone cases, bookmarks, and planners, are not only beautifully designed and practical but also give consumers a sense of cultural inheritance. These examples demonstrate China's immense potential

and innovation in design, creating culturally rich and modern functional products through the integration of traditional culture and modern technology. This enhances China's international design competitiveness and showcases the unique charm and innovative spirit of Chinese culture to the world.

Chinese higher education in art design plays a crucial role in cultivating new design talents with Chinese characteristics, style, and spirit. Moreover, with over 5000 years of history, Chinese culture is vast and profound, offering inexhaustible creativity from tangible and intangible cultural heritages like Chinese characters, historical museums, and folk temples. Chinese national culture should not remain static. Clever integration of science and technology can make it fashionable today. Traditional culture is a product of history, while scientific technology and art design education are continually innovating and developing. They are contradictory yet interdependent, and their integration process is the resolution of contradictions. Old things integrate into new things, new things become old things, contradictions arise and dissolve continuously, repeating perpetually. This is the power of traditional culture, the power of education, and the power of scientific technology.

#### **4. GREEN INTEGRATION: SYMBIOSIS OF NATURE AND TECHNOLOGY**

In today's world, the rapid development of technology has greatly changed our way of life. However, in the process, the natural environment has suffered varying degrees of damage. Finding a balance between technology and nature, enabling their symbiosis, has become a pressing issue in modern society. This not only affects the quality of life for people today but also concerns the well-being of future generations. Technology and nature are not distinctly separate; in fact, they are interwoven and symbiotic. Technological development often serves nature and humanity better. Through the application of technology, humans can more efficiently utilize natural resources, improve productivity, and enhance quality of life. Simultaneously, the laws of nature, whether in its stability or unpredictable changes, provide inspiration and direction for technological development. It is precisely because of the close connection between technology and nature that we can find a balance of symbiosis.

In cultivating future designers, achieving harmonious coexistence between technology and nature through education involves understanding and practicing ecological responsibility and social responsibility. However, the symbiosis of technology and nature is a complex and multi-layered issue. Achieving this goal in fundamental design education requires multiple approaches. Firstly, the adjustment of curriculum and teaching methods: the curriculum should cover interdisciplinary fields between technology and nature, such as biomimetics, bio-design, and ecological engineering. Through these courses, students can learn about the marvelous structures and functions in nature and how technology can draw inspiration from them and transform them into practical applications. Secondly, project-based learning is an important teaching method in the basic education stage to achieve the integration of technology and nature. For instance, introducing ecological crisis design projects can deepen the concept of the symbiosis of technology and nature. These projects aim to solve actual ecological crisis issues, such as marine plastic pollution, deforestation, and urban smog. Lastly, emphasis on field studies and practical teaching: the natural environment and real-world problems are the best classrooms. Through immersive field studies and practical teaching, students can gain a more intuitive understanding of the combination of nature and technology. Schools can organize visits to nature reserves, and eco-friendly factories, to understand real ecological problems and technological solutions. Additionally, students can be encouraged to participate in community environmental design projects, such as designing green buildings and eco-parks. This practical experience enhances their design capabilities and environmental awareness.

## **5. BOUNDARYLESS INTEGRATION: BREAKING BARRIERS TO FORM A COMPREHENSIVE SYNERGY**

Traditional art design education often focuses on creativity and aesthetics, but in today's society, students need a more diverse set of skills and abilities. The rapid development of science and technology demands that students possess more comprehensive capabilities, including multi-dimensional thinking, communication skills, a sense of order, a global perspective, resilience, an understanding of systems, a sense of time and space, and leadership. How to better shape these abilities

has become an important issue in today's educational field. Social, scientific, cultural, economic, political, and ecological aspects all influence design, and each issue is a global concern. Looking to the future, integrating multi-dimensional forces can create a new win-win situation. By connecting different professions and fields and participating collaboratively, a vast network of knowledge can be formed, providing humanity with continuous knowledge and experience. As the Chinese scholar Ji Xianlin believed, talents in the 21st century should be proficient in ancient and modern knowledge, Western and Eastern knowledge, and liberal arts and sciences (three thorough understandings), encouraging interdisciplinary integration that meets the needs of modern society's development.

Design fundamental education is a crucial stage for laying a solid foundation, requiring a broad base. Only with a wide knowledge base can students have more possibilities in their future professional studies and career development. A broad base means learning not only the theories and techniques related to design but also basic knowledge from other disciplines, such as science, technology, engineering, mathematics, social sciences, and humanities. This extensive knowledge accumulation helps students form a comprehensive perspective and diverse ways of thinking, enabling them to stand out in design innovation. Specifically, interdisciplinary integration in fundamental design education can be achieved in various ways. For instance, by combining engineering principles, students can learn how to integrate functionality and aesthetic design to create practical and beautiful works. Integrating technological knowledge into design courses, students can master the latest design tools and technologies, such as computer-aided design (CAD), 3D printing, and virtual reality, expanding their design means and expression forms. Additionally, knowledge from social sciences and humanities can enrich the content of fundamental design education. By understanding human behavior, psychology, and cultural backgrounds, students can better grasp user needs and design more human-centered and life-friendly products. Integrating economic and business knowledge can help students understand market operations and business models, enhancing their market sensitivity and entrepreneurial abilities. Interdisciplinary integration is reflected not only in curriculum settings but also through cross-disciplinary, cross-institutional, cross-field, and cross-border research workshops or project teams.

These workshops and project teams can vary in form, from short-term academic exchanges to long-term research collaborations. Through these platforms, students can not only engage with experts from various fields and learn about research frontiers but also deeply communicate with peers from different disciplines, sparking creativity. Moreover, practical project collaborations allow students to apply theory to practice, enhancing their problem-solving abilities. In the process of interdisciplinary research, students' subjective initiative and artistic imagination are particularly important. Creating an open and free academic atmosphere, encouraging active participation, and fostering initiative and creativity can effectively stimulate their artistic imagination, incorporating more novel elements and ideas into their designs. Multi-party participation and resource sharing can form a powerful research synergy, improving research quality and efficiency.

Fundamental design education is like a vast fertile land, and interdisciplinary integration is the nourishing stream that enriches this land. Only the convergence of diverse knowledge streams can nurture innovative blossoms. In the context of coexistence and mutual promotion in an era of diversity, interdisciplinary integration, breaking barriers, and collaborative innovation replace outdated thinking patterns and produce different methods for solving problems. This not only helps us explore the inheritance and innovation of art in the intersection and integration of multiple disciplines, establishing a model for our fundamental teaching but also helps update and upgrade the fundamental teaching models of higher art design education in China, better meeting the needs of cultivating versatile and innovative talents for social development.

## 6. CONCLUSION

No discipline is developed overnight; it is a long-term systematic project that needs continuous iteration and upgrading with the progress of the times. In the future teaching of art design, the implementation of basic education activities should be combined with the current needs of social development, making appropriate changes and innovations to better implement basic education and lay a solid foundation for achieving educational goals and plans. Therefore, in the trend of integrating art and technology, the construction of fundamental education in art design should not only respect the characteristics of art and science and the

laws of talent growth, strengthen thinking education, cultivate students' artistic and scientific thinking, and emphasize technological development while also paying attention to compatibility and integration with traditional culture and natural ecology. It should transcend general knowledge transmission, exploring new models of interdisciplinary and cross-boundary talent cultivation. Additionally, it should strengthen the sense of mission, promote educational innovation and development, and cultivate a new generation of art talents capable of bearing the responsibility of national rejuvenation.

## REFERENCES

- [1] Zheng Yonghe, Lu Yangxu. New Ideas for the System Design of Cultivating Top Technological Innovation Talents in Basic Education [J]. *Science and Society*, 2022, 12(01): 15-18.
- [2] Tian Zhongli. The Integration of Art and Technology — Thoughts on the Construction of “New Arts and Sciences” in the Context of “New Liberal Arts” [J]. *Beijing Education (Higher Education)*, 2021, (06): 52-54.
- [3] Wang Pin. Connotation Dimensions and Goal Orientations of Intelligent Network Learning Spaces [J]. *Logistics Engineering and Management*, 2022, 44(04): 175-177+165.
- [4] Zhang Xinrong. The Visual Communication Design Teaching at the School of Design of Central Academy of Fine Arts as a Whole or Part of Teaching Reform [J]. *Decoration*, 2020, (06): 24-27.
- [5] Xi Chengsun, Lu Shediao. Research on the Innovation of Integration of Art and Technology in Fundamental Design Education [J]. *Daguan*, 2024, (03): 121-123.
- [6] Chen Yuehong. Chen Yuehong: Thinking about Future Design with a “Fusion” Mindset [J]. *Design*, 2021, 34(22): 42-45.
- [7] Zhou Xian. On the Aesthetic Empowerment in Scientific Discoveries [J]. *Academic Monthly*, 2023, 55(06): 140-149.
- [8] Chang Ying. Research on the Empowerment of Art Design Professional Practice Teaching by Chinese Cultural Genes [J]. *Art Education Research*, 2023, (19): 136-138.

- [9] Cai Degui. Exploration of New Liberal Arts in the United States and Its “Doubts” and “Difficulties” [J]. *New Liberal Arts Theory and Practice*, 2022, (03): 115-122+128.
- [10] Chen Zhengyu. Exploration of Smart Education Concepts and Methods Based on Blended Teaching Models in Art Design Teaching [J]. *China Multimedia and Network Teaching Journal (Mid Edition)*, 2022, (07): 33-36.