

Analysis on the Course Construction and Practice of 3D Printing and Digital Sculpture in the Context of Anti-discipline

Miao Cui¹ Ran Zhao² Qingpeng Zhou³

^{1,2,3} School of Digital Arts & Design, Dalian Neosoft University of Information, Dalian, Liaoning 116033, China

ABSTRACT

This article first explores the theoretical origins and contemporary analysis of the "anti-discipline" theory proposed by Professor Neri Oxman of Massachusetts Institute of Technology. Then, it elaborates on the construction and practical process of 3D printing and digital sculpture courses, and summarizes the relevance of the course's specific project achievements and the development of contemporary cultural industries. It is hoped to providing innovative, pioneering, experimental, promotional, and integrated theoretical basis and practical possibilities for the development and construction of China's cultural industry and 3D printing digital sculpture courses, as well as the commercial transformation of course achievements.

Keywords: *Anti-discipline, 3D printing and digital sculpture, Course construction and practice.*

1. INTRODUCTION

The great philosopher Socrates of ancient Greece once said, "The only thing I know is that I know nothing." Socrates' sentence implies dialectics and paradox, which essentially means always having a spirit of exploration and a spirit of questioning. This is in line with Laozi's "Tao Te Ching", which originated from the thought of "The Book of Changes" in China, which echoes that "the Tao can be said, but it is not the common Tao". Mr. Xu Zhuoyun, a cultural researcher, regarded "The Book of Changes" as a "pre science" in his book "Chinese Cultural Spirit", and his highly abstract symbol "Tai Chi" achieved harmonious unity through mutual transformation in binary opposition. In the contemporary society, this kind of thought is of great universal value, and it connects the ancient and modern, that is to say, this kind of decentralization is not unique, and it is also an inevitable choice for the development of the times. It also means to cross the border and fill the gap,

and this ideology is undoubtedly more suitable for the development of contemporary uncertain society.

2. ANTI-DISCIPLINE

In 2014, Neri Oxman, a professor of art and science at MIT, described how she innovated in four related technical fields, namely computing design, 3D printing, synthetic biology and material engineering, in her speech entitled "Unique Design of the Intersection of Science and Technology and Biology". At present, many of her and her team's works have been permanently collected by top science museums or art galleries in the world. Professor Neri Oxman was once hailed by the "New York Times" as the "contemporary Leonardo da Vinci" and is therefore considered by the industry as the "boldest interdisciplinary thinker in the world." Her research team applied design principles and natural elements to innovative technologies in an interdisciplinary manner, as shown in "Figure 1", a silk pavilion.

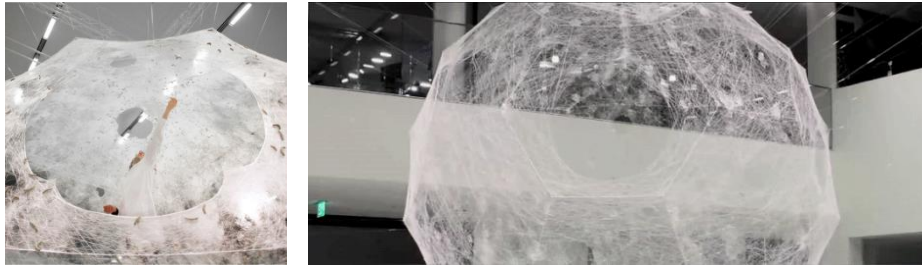


Figure 1 A silk pavilion made of 6500 silkworms created by the Neri Oxman team based on the integration of materials ecology, architecture, natural and biological environments [1].

French philosopher Bergson pointed out in his philosophical theory that "life is a continuous flow of internal impulses, hindered by material obstacles, forming plants, animals, and humans". He believes that the development of life or things is to constantly explore with keen tentacles, and form new things through continuous integration, derivation, and extension. In addition, his moral and religious views also advocate transcending rigid forms and dogmas, and pursuing the vitality and fraternity of the subject. Leslie Federer, the pioneer of contemporary American cultural criticism, also put forward the idea of "crossing the boundary and filling the gap" in his works, "that is, to clear up the distance between art and life, the independence of tradition owned by art has disappeared, life has entered art, and art and life no longer have any difference." [2] To sum up, anti-discipline education is not the opposite of disciplinary education, but rather the crossing and integration between disciplines, breaking the boundaries of disciplines, and brewing innovative forces through mutual transformation to adapt to the many uncertainties in contemporary social development.

3. 3D PRINTING TECHNOLOGY AND THE STRATEGIC DEVELOPMENT OF NATIONAL CULTURAL INDUSTRY

The history of 3D printing can be traced back to the United States at the end of the 19th century. In recent years, it has developed rapidly in China. In terms of fields, industry, architecture, design, there are nanoscale 3D printers manufactured by Germany's nanoscribe company [3], 3D printers that can print biological substances developed by Professor Neri Oxman's Media Lab at MIT, and so on. Driven by technological advancements such as 5G communication technology and AI artificial intelligence, the cultural industry chain is moving

towards a forward-looking development and growth trend of "point - line - surface".

In addition, the implementation of the innovation driven development strategy, the implementation of the manufacturing power strategy, and the promotion of educational modernization are all mentioned as the core in the national 13th and 14th Five Year Plan outlines. In the field of engineering education, outcome based education (OBE) is appropriately adapted to this forward-looking thinking. On the basis of cultivating morality and talent, the fundamental task is, based on strengthening moral education and cultivating people, to cultivate students' innovative ability, highlight the theme of connotation development, apply new theories, new knowledge, and new technologies to update teaching content, pay attention to the cultivation of students' academic and application abilities, strengthen practical teaching, and focus on cultivating new talents for creative innovation and entrepreneurship. In the classroom, the student identity truly shifts from passive to active, and compared to traditional courses, teacher-student interaction is closer. It is necessary to cultivate students' interest, output concepts into reality, convert assignments into appearance patents, and convert patent designs into commercial profits. In the teaching process, successful cases have a good demonstration effect on the entire professional learning, which not only gains confidence in creation, but also stimulates students' innovation and entrepreneurship awareness. As contemporary artist Anne Warhol's slogan of "everyone is an artist" was put forward, 3D printing technology has broadened the path of "everyone is a designer" and shortened the efficiency of 3D visualization. Therefore, the trend of maker innovation and entrepreneurship is bound to sweep the world.

4. COURSE CONSTRUCTION AND PRACTICE OF 3D PRINTING AND DIGITAL SCULPTURE

Education is the reserve force of industry and the reserve force of Chinese culture output. Since entering the new century, the cultural industry has once again presented phenomenal creative products through digital art. As Mr. Wu Guanying said, "The development of digital art can not be separated from great efforts and long wait... It is no exaggeration to say that China's cultural renaissance will be carried out in the field of digital art." [4] Art education is intended to cultivate cultural and artistic creators with professional knowledge and skills, and independent artistic spirit and cultural character. Dr. Wang Lei, one of the founders of Xuberance, has a clear attitude when it comes to 3D printing: "3D printing is the material culture of the present era and will gradually become a part of social culture." [5] This just confirms Leslie Federer's view of "crossing the border and filling the gap". The digital sculpture course with 3D printing output has become the medium of professional production, teaching, research and curriculum group of digital art, bridging the boundaries and barriers between courses, and even integrating art and technology organically, which is an example of modern scientific and technological development assisting art teaching. As Flaubert in France said, "Science and art will eventually meet." Therefore, cross-border attempts are also one of the construction directions of 3D printing and digital sculpture courses. After four academic years of construction and practice, the important links and experiences of its development can be summarized:

Firstly, guided by national ideology and development strategy, it is necessary to promote the development of China's cultural industry and gradually form a mature cultural industry chain that links artistic image creation, and cultural products' production, supply, and sales. Cultural products, as the most valuable and potential part of the entire digital art industry chain, have become a consensus. Teachers of the curriculum team can boldly innovate and practice in combination with national policies, college teaching reform and industrial development, and make teaching achievements with promotional value and significance in theory, technology, culture and practice.

Secondly, in terms of course construction, new theoretical knowledge related to 3D printing technology is introduced into the traditional digital sculpture curriculum system, allowing students to master the basic principles of cutting-edge technology 3D printing technology, understand the digital model production and production technology related to 3D printing, expand their knowledge, improve their employment ability, and cultivate creative innovation and entrepreneurship talents with good theoretical and technological foundations. With the continuous improvement of TOPCARE-CDIO teaching reform in the college, in terms of curriculum construction, it is a must to cultivate talents with good practical abilities and creative and entrepreneurial abilities with patriotism, humanistic values, and original character according to the standards of the cultural industry and cultural industry, as shown in "Figure 2".

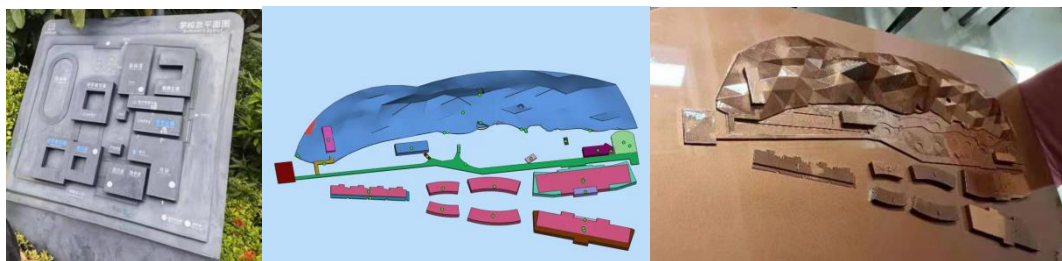


Figure 2 3D printing guide board — 3D modeling, digital carving, and painting after 3D printing.

Once again, in the dynamic evaluation of learning effectiveness, there is a necessity to focus on technological development and introduce 3D printing technology, augmented reality technology, mobile communication technology, and APP development technology into cultural peripheral design projects, leading the way in cultivating cultural talents in China. On the basis of the core

idea of cultivating innovative and entrepreneurial application-oriented talents, it is of great significance to not forget cultural inheritance beliefs and original intentions. The course team teachers should enhance connotation construction, immerse traditional Chinese culture, folk culture, and humanistic care in classroom teaching, and integrate deep experiences and understandings of

Chinese spirit and culture into their works driven by the "original" character. Focusing on cutting-edge technology and industry development, 3D printing technology has been introduced into digital sculpture projects. The mainstream digital sculpture model production technology in the industry, coupled with 3D printing technology representing the forefront of technology, has solved the problem of converting course assignments. Evaluating learning outcomes is a crucial aspect of the OBE teaching model, where what students have learned and whether they have succeeded are far more important than how and when to learn. In addition, 3D printing can also allow students to see their own works more intuitively, understand the advantages and disadvantages of the works, and gain a greater sense of achievement, which can also enhance students' creative and innovative practical abilities, and promote the integration and development of culture and technology.

Finally, in the practical innovation part guided by actual commercial projects, teachers of the curriculum team set out from the "three-dimensional modeling" school level boutique course to complete the reform practice of cultural peripheral design projects, the design and development of traditional folk cartoon cultural and creative products, the exploration and practice of the training mode of innovative experimental class of digital art, the design and development of film and television culture derivative products, research and development and distribution of AR augmented reality picture books, research and development of the original cartoon brand "Donki", and research on the combination of 3D printing technology and

cultural peripheral products. They have created a large number of commercial products, patented products, award-winning works, exhibition and display works, training achievements of national college students' innovation and entrepreneurship projects, "14th Five-Year Plan" textbooks and international conferences, Chinese domestic core paper achievements, etc. Through mobile platforms, online exhibitions, campus exhibitions, and other media, teaching achievements can be promoted comprehensively and from multiple perspectives, and highly praised. The practical and innovative abilities of previous students can be significantly improved, winning nearly multiple awards and patent applications in national competitions. And graduates' employment units can highly evaluate the professional ethics and practical abilities of students in this major.

In summary, classroom learning, relying on exhibitions and online displays, can fully showcase the teaching achievements of the course. Classroom teaching has resulted in a large number of works by students, and some students have designed works through 3D printing, integrating aesthetics, meaning, and design sense, and completed the application work for appearance patents, as shown in "Figure 3". Since the beginning of the course, with the continuous improvement of teaching evaluation for digital sculpture courses based on 3D printing results, student works have been continuously presented in exhibitions and competitions, and even played a good teaching demonstration role throughout the province, forming a good promotion effect.



Figure 3 Students' classroom digital sculpture model and 3D printing physical results.

5. CONCLUSION

There is also a dialectical relationship between humans and technology, where humans use technology and invent it. In the process of using technology, people are inevitably constrained by it. Only by constantly breaking through technology can they promote their own innovation. At present, the world is ushering in an uncertain era, where

there are no universally applicable educational standards or fixed educational rules between disciplines, education, and the cultural industry. It is necessary to combine undergraduate colleges at different levels and different types of industrial talents, teach according to their aptitude, adapt to individual needs, and use the OBE education model based on learning output. Through comprehensive practical training projects, teachers and students

will test teaching results, keep up with the times, and innovate and develop, becoming a strong voice in contemporary education. At the same time, this process requires accumulation and gradual precipitation, ultimately leading to the expression of national cultural consciousness and imagination.

REFERENCES

- [1] Neri Oxman's MIT homepage [EB/OL]. <https://neri.media.mit.edu/projects.html>
- [2] Yang Xiangrong, Crossing the Border and Filling the Gap — A Reflection on Postmodernism Art [J]. *Theoretical Studies in Literature and Art*, 2008 (03): 92-99. (in Chinese)
- [3] Two Photon High-precision Micro Nano 3D Printing System [EB/OL]. <https://www.nanoscribe.de/en/products/photon-ic-professional-gt/>
- [4] Wu Guanying, Ye Feng, Digital Art Education Should Lead the Development of the Industry [J]. *Art & Design*, 2011, No.213(01): 122-124. (in Chinese)
- [5] Huang Dequan, 3D Printing, Xuberance [J]. *Art & Design*, 2015(08): 52-57. (in Chinese)