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Study on the Cross-Curriculum of Visual Communication Design in the Context of "New Engineering"

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Abstract: *The construction of the new engineering discipline has put forward new requirements for the cultivation of innovative talents. This paper analyzes the current situation, problems and challenges faced by the visual communication design major, and proposes to base on the concept of the new engineering discipline and establish a cross-border integration curriculum in the context of technological and media changes, society's demand for design and the perspective of users; on the other hand, a more meticulous mathematical and rational thinking logic should be established to solve the problem of traditional design discipline's liberal arts thinking in terms of imagination and vague concepts for design strategy formulation, design concept On the other hand, it is necessary to establish a more mathematical and rational thinking logic to solve the contradictory problems between the traditional liberal arts thinking of design and its practical application. In the context of the new round of technological revolution and industrial change, the programme will break the disciplinary barriers and form a new model of interdisciplinary and complex training in design.*

Keywords: *New Engineering; Mathematical Thinking; Cross-border Integration; Composite*

1. Introduction

In order to adapt to the new trend of the new round of scientific and technological revolution and industrial changes, closely focus on the needs of national strategies and regional development, accelerate the construction and development of new engineering disciplines, explore the formation of an engineering education system with Chinese characteristics and world standards, and promote China's development from a large engineering education country to a strong engineering education country. The Ministry of Education has gradually released measures on the research and practice of new engineering disciplines since 2017. in 2018, based on the Opinions of the Ministry of Education on Accelerating the Construction of High-level Undergraduate Education to Comprehensively Improve the Cultivation of Talents, the proposed new engineering disciplines have not only become the development direction of engineering education, but also the main method to comprehensively improve the cultivation of talents in various disciplines [1].

The world's economic and industrial development has gone through the industrial revolution, the Internet, mobile Internet to artificial intelligence. The New Engineering is a new concept corresponding to the rapid rise of new industries such as smart manufacturing, big data research, cloud computing and upgrading of traditional engineering majors, and is also one of China's important strategies for industrial change and technological revolution in the international market environment, and is a new starting point for China's industrial development. Therefore, the general idea of the new engineering discipline is based on domestic and facing the world. On the one hand, it is closely aligned with the domestic economic pattern, city clusters and industrial chain layout; on the other hand, it takes the opportunity to join the international engineering education "Washington Agreement" organization to develop national warfare such as serving manufacturing power [1]. At the same time, the new engineering construction pays more attention to the cultivation of future-oriented talents. Under the new concept of engineering education, we constantly deepen the education reform and accelerate the cultivation of technical talents oriented to new science and technology and changes, in order to form a constant source of new technology. Obviously, knowledge production and talent cultivation are interoperable and mutually constructive, based on the logical chain of the purpose orientation, content organization, contextual approach and subject composition of the knowledge production mode and its transformative features such as application orientation, multidisciplinarity, problem practice and pluralistic synergy, which constitute the

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new requirements of the talent cultivation mode [2]. Since its inception, the study of design has been centred on "problem solving" [3]. In the context of technology, the object of problem solving has changed from visible objects to invisible 'experiences', 'architectures' and 'services', which has led to an increasingly broad range of problems and a blurring of the boundaries of design. This has also led to an increasingly broad range of design issues, a blurring of the boundaries of design, and a gradual increase in the cross-border integration of design disciplines, as well as an evolution towards a more scientific and integrated interdisciplinary training of design professionals.

2. Ideas for the Construction of Visual Communication Design Major Based on "New Engineering"

2.1. A Fissionable, Derivative Teaching Philosophy

According to the new requirements of the "New Engineering" for the education reform of higher education and professional technical education in China, the teaching of some existing professional courses can no longer meet the requirements of cultivating talents under the background of the New Engineering [4]. In particular, the key tasks and initiatives of the reform put forward some new directions to carry out in-depth new practical research, strengthen the close connection between disciplines and practice; establish new concepts of engineering education, innovate new modes of education and teaching organization; improve the innovation and entrepreneurship education system, promote the close integration of innovation and entrepreneurship education with professional education, focus on cultivating students' design thinking, engineering thinking, critical thinking and digital thinking, and enhance innovation spirit, entrepreneurial consciousness and innovation and entrepreneurial ability[1].

The alternation of computer technology and media platforms has driven the rapid development of the level of visual communication design. Whether in the form of visible communication of information such as commodity circulation, market economy, brand communication, poster propaganda or in the field of implicit communication of content such as social organisations and service structures, the expression and communication of visual media such as text, graphics and colour have all produced changes. On the one hand, there has been a change in traditional technology and media. From inked paper media to electronic display media, from static text to multi-sensory, all-round reading of graphics such as sight, sound and touch, the way in which information is disseminated has changed. Not only has it broken the traditional era, the problem of a single mode of information, but it has also provided more channels for the audience, thus enhancing the efficiency of information conveyance. At the same time, the update of the algorithm mechanism has pushed the media platform to achieve the timeliness, prominence and interest of information as well as accuracy and personalisation. This has greatly increased the aesthetic awareness and value standards of the audience. On the other hand, there has been a shift in the design orientation of design interventions in social issues. People have begun to think consciously about the object of design, to explore the process of its realisation through a deeper understanding of the 'design products' of everyday life, and to discover the deeper meaning and value of design. As a result, design is no longer limited to 'design', but has become an energy to intervene in social issues and solve them, thus leading to a new 'design vision'. The result of visual design is not only a short-lived means of propaganda and communication, but also a deeper involvement in social issues, providing new and effective solutions to process and result-oriented problems. Therefore, the training model of visual communication design should also follow the changes in technology and the social environment in terms of the criteria for the demand of talents, and constantly evolve and create new integrated courses.

2.2. Cross-Curricular Curriculum

In 1970, Jantsch-E proposed the concept of "supra-disciplinarity", which he believed should promote the cultivation of supra-disciplinary talents, in order to promote problem-oriented education instead of discipline-centered education [5]. At present, many universities in China have attempted to develop their own ideas and propositions on social, technological, systemic, ethical and ecological issues based on the principles of graphic design. A number of cross-border crossover courses are offered at the undergraduate and postgraduate levels. The visual communication design department of Tongji University College of Design and Innovation offers courses in dynamics and media, information and communication, interaction and systems, and sustainable design concepts; the visual communication design department of the Central Academy of Fine Arts offers courses in interactive design and spatial design; the visual communication design department of Jiangnan University School of Design offers comprehensive courses in user research and design definition, integrated innovative design, and incorporates sustainable

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concepts into information organisation and creative design, placing emphasis on students' understanding of anthropology, the concept of survival and development based on the concept of sustainability. Many schools abroad also integrate visual design with architecture, environment and materials across borders to carry out relevant research.

In the global context of the Internet, new information media and experience economy, the Visual Communication Design major at Zhengzhou University of Light Industry focuses on the multi-dimensional connection and integration of technology and art, tradition and modernity, information and interaction based on the background of traditional visual culture, and is dedicated to the exploration of innovative design of visual culture, innovative design possibilities in new media, comprehensive design and cross-border issues, emphasizing the cross-fertilization of multiple professional fields. The programme emphasises the cross-fertilisation of multiple disciplines. New Media Studies and Sustainable Design Studies are offered at the undergraduate level. The two courses are back-to-back, progressively transitioning from the media presentation of information to a focus on social issues. Through the decomposition and practice of new media, New Media Studies enables students to master the language of multiple visual media, to enhance their ability to systematise from concept extraction and transformation to the presentation of multiple media, and to design diverse cross-border works with new means of visual media in a multimodal and multi-dimensional manner. The Sustainable Design course is based on a broader perspective, exploring the value and responsibility of design in the context of the information age, considering the relationship between modern design and the sustainable development of mankind, forming a correlation between design and society, design and culture, design and art, and design and people, looking at the creation of comprehensive propositions such as natural ecology, social responsibility, and cultural heritage from an individual micro perspective, and constantly expanding into new areas. He also focuses on new trends at the forefront of design.

At the same time, in a problem- and practice-oriented design methodology, the boundaries of a designer's knowledge need to be constantly expanded. The introduction of cross-border courses also means that the traditional teaching mindset of a single, vertical approach to teaching is no longer applicable to the new curriculum, and both the teaching philosophy and the teaching methods need to be transformed. How to get rid of the inherent mindset in cross-border courses and address the issues related to the relationship between art and technology is a question worthy of research and exploration.

3. Teaching Reform Based on the "New Engineering"

3.1. Ideas & Methods

In the midst of the new social changes, it is a new concept of design education in the context of "New Engineering" to promote the reform of cross-border talent training mode with sustainable competitiveness by combining new industries and new technologies [6]. The new teaching system is constructed through new teaching contents, which is mainly reflected in the following points. Firstly, the content of the course is more extensive than before. The concept of sustainability includes not only environmental and resource sustainability, but also social and cultural sustainability, so as to achieve the three effects of environmental sustainability, social sustainability and economic sustainability. Therefore, sustainable design in visual communication design should focus more on how visuals can identify and solve social and cultural problems, and be able to break through the 'flat thinking' cognitive limitations of previous courses and transition from specific design methods to a balanced consideration of economic, environmental, ethical and social issues. For example, how visual design can help to address ageing issues; how visual methods can respond to online education; the ethical aspects of positive communication of information; and user research that is closely related to the target audience of information dissemination. Secondly, the design approach is more multidimensional. Facing the integration of cross-curricular courses, teachers should explore and research teaching methods. Sustainable design research covers a wider range of topics and requires fieldwork, practical research, questionnaire design, statistical analysis and the creation of some analytical models for more detailed qualitative and quantitative analysis according to the research content.

3.2. Approaches & measures

Tongji University's sustainable design theory course, in collaboration with Tencent Hootsuite Social Value Research Centre and Robleth, provides new academic theories and technical support, and takes the action plan of carbon emission peaking by 2030 proposed in the State Council government work

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report on March 5, 2021 as the background.

The sustainable design research course at Zhengzhou University of Light Industry is divided into three main stages: theoretical teaching, data research and design practice. The first is a theoretical learning method that focuses on the focus problem and understands the intersection theory in reverse. According to the characteristics of the course and the needs of the "New Engineering" for the cultivation of students' practical skills, the course aims to collect relevant cases for the cross-disciplinary, theoretical and abstract knowledge points, and to sort out the concepts in the analysis of practical cases in the "reverse" direction. Students will be guided to develop a sustainable orientation towards the use of visual design methods to face the focal points of social and cultural development, and to establish a sustainable orientation towards socially innovative design based on visual design perspectives across borders. The content of the course is streamlined and optimised to include basic concepts, core theories and directions of evolution and change, with the definition of sustainable goals and scope and the role of visual design methods as key elements. Secondly, the "new practicality" of the "new engineering" focuses on the relevance of teaching projects to practice, emphasising the focus on social hotspots, key issues and sustainable development issues at the early stages of research, and establishing the concept of solving real-life problems through design. Students are encouraged to develop the core values of their chosen topic through scenario observation, fieldwork findings, user research and comparative analysis after initially establishing the scope of their research. At the same time, different solution strategies should be proposed based on a large collection of relevant solutions and inductive analysis; on the other hand, hierarchical objectives with different focuses should be established, gradually converging into a three-dimensional and more relevant research framework from different viewpoints, such as public, corporate, designer and user, as well as design values, design themes, design implementation and design summaries. Especially important is the re-examination of the significance of the selected topic in terms of authenticity, urgency, feasibility of design intervention and foresight, the positioning and grading through the decomposition of data from statistical analysis, the imagination of creative thinking and vague concepts more precisely aligned with the actual problem, thus solving the real problem and increasing the design value in the later design process. Ultimately, in the design practice stage, the driving force of rational thinking awareness on scenarios, needs, users and problem focus is emphasised. Based on the three-dimensional layered design framework, in the three stages of initial discovery, mid-term optimisation and end retrospection, design themes on different directions such as behaviour, gender, education, transportation, travel and health are formed through an integrated approach of visual information, visual modelling and visual media. Not only does it change the previous perceptual inertia of analysis, but it also develops interdisciplinary design awareness, mathematical design methods, and rigorous logic in the analytical methods of statistics, psychology and other disciplines, cultivating new design thinking, engineering thinking, critical thinking and digital thinking in students.

4. Conclusion

In the context of the "New Engineering", new discussions on the evolution and reform of different disciplinary education models have begun, and frontline educators are also deepening their understanding of the guiding ideology, teaching system, cultivation paths, practice methods, as well as curriculum, teaching objectives and teaching methods of the design education discipline in the process of accumulation and accumulation, constantly incorporating new ideas and methods in the innovation of design boundaries and design purposes. The new challenges faced by higher education institutions The new challenges faced by higher education institutions are divided into several different situations. The first is for design majors in art schools, how to develop a rational sense of thinking and discernment in a strong aesthetic atmosphere and sensual creative thinking, to promote design practice in a better aesthetic appreciation and creative ability, and to be able to transform it into a practical project with a high level of aesthetic value. Secondly, design majors in liberal arts colleges should dare to break through the liberal arts attributes of design and change their thinking to form new disciplinary strengths. Through interdisciplinary courses, we can establish a link between theory and practice, and guide the building of a sense of innovation in the context of rigorous rational and logical thinking. Comprehensive universities, on the other hand, can give full play to the characteristics of multiple disciplines, break down disciplinary barriers, make full use of the advantages of engineering disciplines, and jointly promote the reform of design education and teaching, establish a path for the cultivation of innovative talents with the synergy of mathematical and scientific thinking and perceptual awareness, and form a new model for the cultivation of innovative talents.

In today's world of advancing technological revolution and industrial change, the integration of multiple cultures and individualised user needs, design purposes, roles and values are full of diversity,

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and both technical means and design methods need to seek more crossover paths. In particular, the visual communication design profession has to break through the inherent thinking in the changing traditional media and visual boundaries, crossing professions, perceptions and modes, and exchanging and integrating between different industries and professions. Facing the world and the future, closely dovetailing with economic belts, city clusters, industrial chain layouts and social, cultural and human issues to collide thinking and generate new sparks. More importantly, external diversity changes are constantly expanding the boundaries of the design profession's internal perception. Whether it is the shaping of brand values based on commercial purposes or the intervention of social issues, the audience's access to information is expanding, blurring boundaries and real-time immersion, generating a multi-party collaborative information format, even as its openness, process, stages and continuity continue to strengthen, and a rigorous approach to engineering research contributes to the effective enhancement of design efficiency. In particular, in visual communication education, a new educational model that responds to the requirements of the context can be formed, constantly improving the ability of visual communication in the rapid development of society and culture, meeting the different needs of people for information and bringing into play the value of visual design in the midst of technological and technical change.

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