Curriculum System Reform for Application-Oriented Undergraduate Course of Visual Communication Design Major in the Era of Artificial Intelligence

Xuejun Zhu[1,a]*, Xuan Wan[1,b], and Chao Pan[2,c]*

{[a]xjzhu@sandau.edu.cn, [b]751939880@qq.com,[c] panchaoelena@126.com}

[1]Shanghai Sanda University, No. 2727 Jinhai Road, Shanghai, 201209 ,China
[2]Shanghai International Studies University, No. 1550 Wenxiang Road, Shanghai 201620 ,China.

*Corresponding authors: Xuejun Zhu and Chao Pan

Abstract. Based on the perspective of application-oriented universities, this article aims to study how to cultivate core competencies of visual communication design students that are irreplaceable in the era of artificial intelligence. It explores a practical and feasible "intelligence + visual design" curriculum system reform idea, proposes two education reform concepts of "art-science" and "cross-border", and puts forward specific plans in six aspects: the structure of the professional courses system, teaching modes of professional courses, theoretical teaching systems, practical teaching systems, presentation modes of curriculum system achievements, and quality evaluations of curriculum system achievements.

Keywords: Art-Science, Artificial Intelligence, Cross-border, Curriculum System, Visual Communication.

1 Introduction

1.1 Context of the study

In the context of the new era, with the rapid development of artificial intelligence and mature technology, visual communication has seen significant advancements. For instance, using AI programming, a computer can now complete high-quality poster designs in just minutes. Case experiments have demonstrated that multiple design solutions can be automatically generated within 10seconds with the help of AI data analysis and language processing techniques. These breakthroughs showcase the disruptive shift that the entire industry is experiencing. This shift will undoubtedly have an impact on the talent training model of visual communication design education, and this new reality must be confronted.[15] How to integrate traditional curriculum and teaching methods in this field with AI technology alongside the overall development of the design industry remains a question worth serious consideration.[1]

1.2 Review of the current state of the study

Design education in the era of artificial intelligence is a top priority for all universities, with different focuses. Research universities like Tongji University emphasize a strong research

ITEI 2023, November 24-26, Zhengzhou, People's Republic of China

DOI 10.4108/eai.24-11-2023.2343564

platform and international, interdisciplinary research-based teaching. Meanwhile, application-oriented universities face greater challenges and must balance their unique characteristics with transformation feasibility on the road to change. [2]

As a result, cultivating application-oriented talents in visual communication design during the era of artificial intelligence remains a critical objective that requires in-depth research and practical application. This presents a challenge that application-oriented universities need to prioritize.[3]

1.3 Project reform objectives

The primary objective is to cultivate students' creativity, cross-border, and art-science abilities. Through these efforts, students can acquire critical competencies and qualities that are indispensable in the era of artificial intelligence, and which cannot be replicated by machines.

Based on the framework of application-oriented universities and Shanghai Sanda University, a practical reform idea and curriculum system plan of "intelligence + visual design" is proposed.[6]

This project aims to provide valuable insights for the educational reform of visual communication design majors in similar application-oriented universities.[9]

2 Main Study Content

Our study focuses on how to cultivate irreplaceable core competencies among visual communication design students in application-oriented universities during the era of artificial intelligence - taking into consideration the unique conditions of each institution. This effort leads us to explore practical reform ideas on the "intelligence + visual design" curriculum system.

We also propose two education reform concepts, "art-science" and "cross-border," and present specific plans across six areas: the structure of professional course systems, teaching modes of professional courses, theoretical teaching systems, practical teaching systems, presentation modes of curriculum system achievements, and quality evaluations of curriculum system achievements.[2]

2.1 Reform the Structure and Layout of Professional Curriculum Systems

Using the "art-science" and "cross-border" concepts as a foundation, we restructured the professional curriculum and created an application-oriented curriculum system centered around "creative ability". Specifically, we refined the two core course groups of the major: "Data Visualization" and "Brand System Design"; while fine-tuning the "User Interface Design-1/2" course group.

As illustrated in the table below*(Figure 1)*, the course groups of "Data Visualization", "Creative Programming", "Integrated Design (Data Visualization)" and "Web Front-end Programming" are added to the original "Information Visualization Design" course.

The course group of "Brand System Design" underwent changes which were based on the original professional core courses but, furthermore, reinforced the “brand” series concept. We

emphasized the link between brand and packaging design and also placed additional emphasis on brand design with regionally oriented symbols through the course “Visual Symbol Design and Expression”.

The course group of “User Interface Design-1/2” underwent an overhaul, emphasizing the diversification of the application side, extending from web and mobile to virtual reality (VR), augmented reality (AR), smart wearable product interfaces, and other application scenarios. The course also facilitates the “1+X” certificate cooperation with the Ministry of Education, and the course content adheres to the assessment content of Tencent’s “Professional Qualification Certificate of Interface Design (Advanced)” examination.

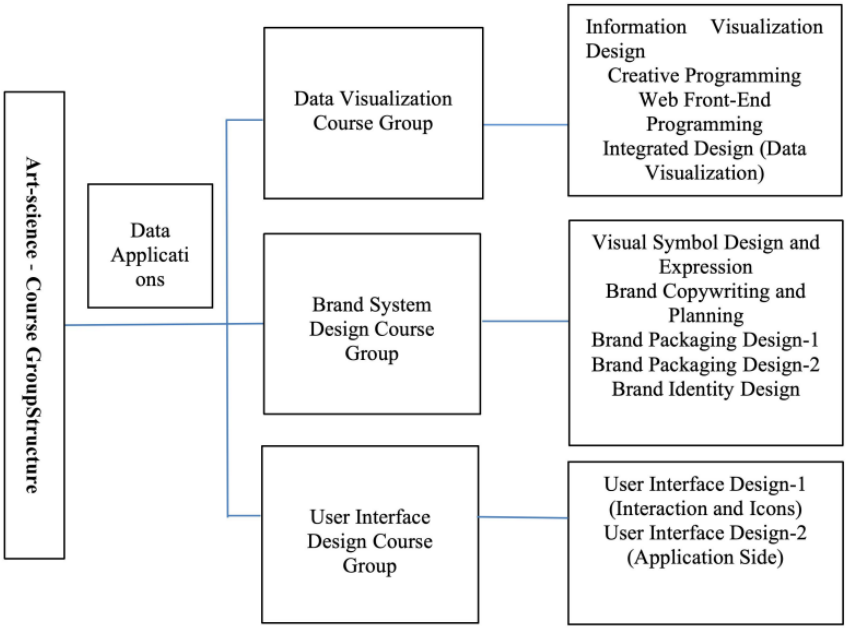

Figure 1. Structural of art-science integration course groups under artificial intelligence thinking.

The curriculum structure reform mainly reflected the “cross-border” concept through three new courses, namely, “Ceramics and Decorative Modeling”, “Innovative Design of Folk Art”, and “Dynamic Display Design”. The final results of these courses are mainly implemented in the design of regional cultural and creative products as well as comprehensive exhibition forms, illustrated in the table below(Figure 2).

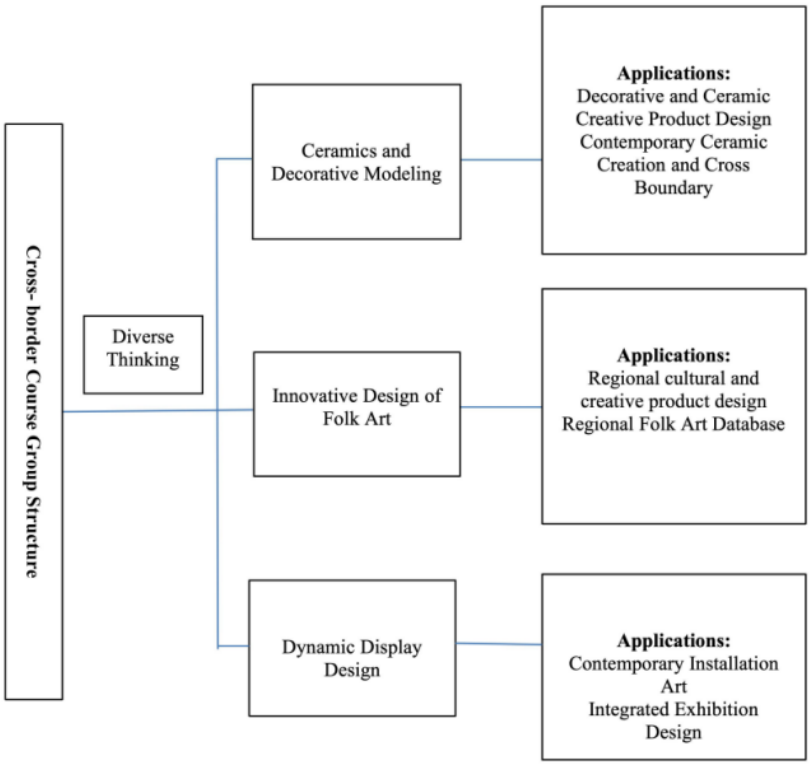

Figure 2. Structure of course groups in the perspective of cross-border and interdisciplinary applications.

2.2 Reform of the teaching method of professional courses

We have implemented a structural transformation of all professional courses in this major from a completely offline course model to an innovative mixed-mode teaching format combining "online + offline" elements.[4]

2.2.1 Offline teaching

In offline classes, we adopt a "small class" approach with case studies, encourage active participation and discussions, and facilitate dual-teacher project collaboration, combining the "demonstration + copying + creation" teaching methods.

The theoretical component of the course, focused on the first four weeks, would be taught using PPT courseware. Full-time teachers will teach in a small class, case-based, participatory and discussion-style manner.

The practical component, which is the main focus of the last four weeks, will involve "demonstration + copying" practice of the theoretical component and "creation" practice of school-enterprise cooperation projects. We will adopt a dual-teacher project type, with "one-to-one" guidance for each student.

2.2.2 Online teaching

We will adopt a “guided approach” using a combination of online and offline face-to-face teaching to carry out the flipped and hybrid teaching method. Students will be encouraged and guided to learn independently online while being able to access relevant course resources such as MOOC and SPOC on the course websites.[7]

Through the “Learning Expert” platform, we will interact with our students, manage coursework, and provide guidance in commonly used design software applications such as PS, AI, AE, etc. [8] The combination of these tools will ensure a more normalized and standardized process in hybrid teaching.[5]

2.3 Reform of Theoretical Teaching System: "Directives" and "Modularity" of Professional Course Content

The professional courses seek to reform the teaching content of “art-science and cross-border” through “three main directives” and “four modules”, using the “Information Visualization Design” course as an example[19] .

2.3.1 Directive 1: Systematic structure: The basic module for the course of multi-dimensional urban information visualization design

The basic module for the course of multidimensional urban information visualization design should be developed from the perspective of four systematic visual transformations and four information dimensions, corresponding to the orderly and complex nature of the city.

Module 1: Dimension 1 (Objective): This module will seek to find the spatial visual transformation of urban territorial dimensions.

Module 2: Dimension 2 (Model): This module will analyze the visual time grouping of urban sustainability dimensions.

Module 3: Dimension 3 (Physical): In this module, innovative media attempts will be made, with a human-centered urban dimension as the focus.

Module 4: Dimension 4 (Ideal Dynamics): This module seeks to achieve a dramatic integration considering the urban culture public welfare dimension.

(Cross-integration of the course and student discussion phase)

2.3.2 Directive 2: Shared Derivation: This directive seeks to incorporate interdisciplinary learning into the teaching practices of Urban Information Visualization.

2.3.2.1 Consistency with the Sense of Grouping

From the perspective of a city as a platform, information visualization’s text, color, and style need to consider the emotional thinking of the people in their respective locations. Attention should not be focused solely on the architectural information model.

To explain this point further, consider the example of Jinshanzui fishing village. It is necessary to base the design on both the overall administrative area and the harmonization of the personal customs and culture of the people.

2.3.2.2 Promotion of Interactive Awareness

In order to enhance the usability of information design and promote an increasing number of data sets being used by the public, it is important to rely on the popularity of mainstream media and social networks. The blogosphere, in particular, can be utilized to increase awareness of information design's usefulness to the public.

2.3.2.3 Focus on Visual Awareness

Designers must ensure that users can easily read and understand visuals without complexity. A multi-sensory visual medium can be utilized to cover different needs. (Course derivation and development phase)

2.3.3 Directive 3: Characterized Performance: This directive aims to conform to the trend of information design under the city brand development strategy.

The primary challenge that needs to be addressed is how to meet the growing demand for swift access to information in our rapidly developing city, while also satisfying the ever-increasing appetite for visual content. How can we efficiently communicate city-related information to our audience? How can we transform city-related information into a recognizable brand? And finally, how can we disseminate and market the city information to a wider audience? As illustrated in the diagram below:*(Figure 3)*

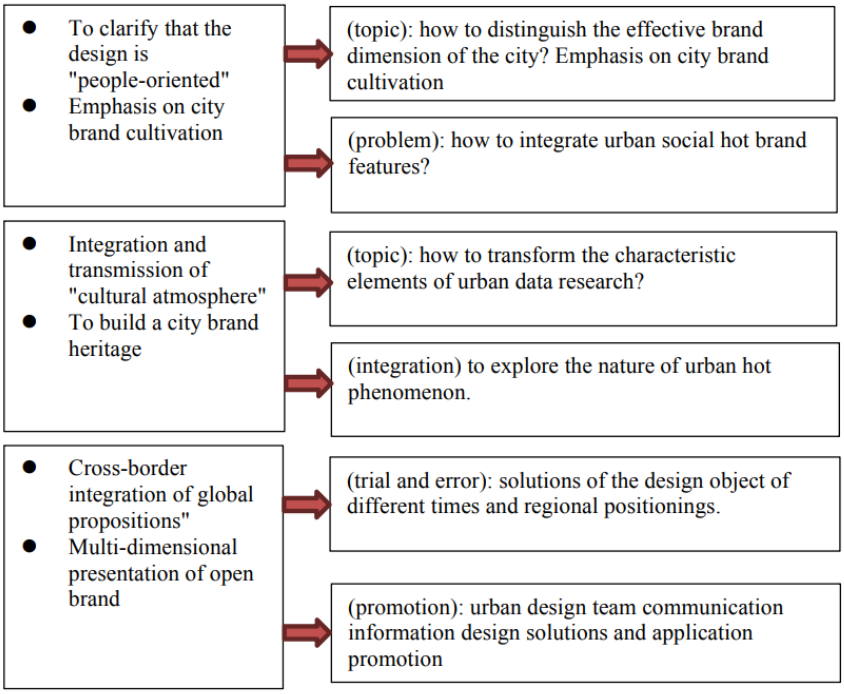

Figure 3. Artificial Intelligence Combined with Information Visualization Course Teaching Ideas.

2.4 Reform of the Practical Teaching System

Artificial intelligence is transforming the work of designers, shifting from long-term, project-based work to short-term, creative work. Designers will transition from being "craftsmen" to "artists," and the professional boundaries of visual designers will no longer be rigid, allowing everyone to embrace the role of a designer.

Within the practical teaching system, this project is designed to improve students' abilities in project integration, cross-border integration, and art-science integration by selecting topics and introducing new technologies that facilitate human-computer collaboration and school-enterprise cooperation.[10]

2.4.1 Practical Teaching of Social and Artistic Subjects

As AI replaces repetitive labor previously performed by designers, visual designers now have more time to engage in research, uncover new possibilities, and explore aesthetics and reinvention.[12]

For instance, consider the course of “Font Design.” Traditionally, Chinese fonts focused on commercial use and universality rather than experimentation or conceptual creativity. The vast majority of fonts aimed at recognition as the foremost priority. Font design ideas were primarily based on existing fonts, and only minor modifications or transformations were made. As a result, designers focused on explicit, existing factors to create beautiful shapes complementing the text but lacked new font library design logic, experimentation, and a more creative, artistic perspective[16] .

2.4.2 Integration of Human-Computer Collaboration Technology into Practical Teaching

We incorporate human-computer collaboration technology into project-based courses. For example, we introduce the Processing creative programming language in the “Information Visualization” course and utilize the Cycle GAN for unpaired training in font lab testing in the “Font Design” course. We also emphasize the use of After Effects and Cinema 4D for dynamic and three-dimensional graphic effects in relevant courses.

2.4.3 Practical Teaching of School-Enterprise Cooperation Projects at High-End Expositions

Through cooperation with industry partners such as Shanghai Dianyi Exhibition Group, we won the bid for the parade project of the China Pavilion at the Expo Dubai 2020. We will also continue to collaborate with "China-Africa Cultural Park" visual design project at the 2nd China-Africa Economic and Trade Expo and the visual image design project for the China Pavilion at the Expo Osaka 2025, and explore potential partnerships with the pharmaceutical industry on data visualization projects.

2.5 Reforming the Way Course Results are Presented

2.5.1 Establishment of a Virtual Reality Exhibition Hall and Online Exhibition of Outstanding Works

Leveraging AR and VR technology available in our faculty laboratory, we successfully established a virtual reality exhibition hall. As an attempt to improve the “online + offline”

diversified exhibition methods, we place exemplary designs from various courses and graduation projects within the virtual reality exhibition hall.[11]

2.5.2 Promoting Exemplary Design Works through an Official Website and Microblog

To further promote our outstanding visual designs, we established a dedicated WeChat official account named “Visual Spruce” for the Department of Visual Communication Design. Through this platform, we promote online exhibitions of exemplary works in conjunction with our faculty’s official website.

2.6 Reforming Curriculum Quality Evaluation Methods

2.6.1 Joint Evaluation by Students and Teachers from Different Professions

The final assignment score comprises of four parts: program design + design presentation + production process + overall completion(*Table 1*):

a. Program designs should offer multiple options and be used on merit, showing students' ability of design thinking, design organization and design management;

b. Design presentation is a basic quality requirement for the cultivation of application-oriented talents, and the assessment of their oral expression skills;

c. The production process reflects mastery of the craft;

d. The overall completion is evaluated for the final design effect.

At the end of each semester, a team of 3-4 interdisciplinary teachers will conduct a comprehensive evaluation of the effectiveness of the students' work presentation and the "online + offline" exhibition, while mutual learning opportunities are promoted among students through the public exhibition of their works.

Table 1. Online + Offline Design Works Scoring Form.

Program Topic Selection and Innovation Consciousness 20%	20 points
Conception and Process of Design Solution 30%	30 points
Visual expression ability 30%	30 points
Overall completeness of the rendering target 20%	20 points

2.6.2 Online Defense of Exemplary Graduation Design Works, with full audience of students and evaluation by interdisciplinary faculty team, industry designers and design media

During these sessions, interdisciplinary faculty teams as well as industry designers and design media with diverse regional backgrounds are invited to evaluate the works. For instance, we strive to invite senior designers from designer associations and well-known design media entities to participate in evaluating the works, thereby promoting industry visibility.

2.6.3 Online Satisfaction Surveys for All Professional Courses

The “Course Satisfaction Questionnaire” is distributed to all students to obtain comprehensive evaluations of the teachers’ professional abilities, teaching styles, emphasis on an integrated

theoretical and practical approach, the reasonableness of assessment methods, emphasis on the learning process, and whether overall abilities have improved, among other aspects. Through receiving such feedback, the teaching team can obtain first-hand materials, which are subsequently used to improve the quality of teaching and the overall student experience.

3 Conclusion of the study

Based on application-oriented university and combining this with real-world practices, we propose the following effective initiatives for reformation of the curriculum system for visual communication design majors in the era of artificial intelligence[13] :

a. Given the age of artificial intelligence, we propose two educational reform concepts: "art-science" and "cross-border".

b. We have reconstructed the curriculum structure for visual communication design, with a focus on the core curriculum groups of "data visualization design" and "brand system design".

c. As part of the practical teaching system, we propose a "human-computer collaborative project design" program that involves the implementation of Processing creative programming language, Cycle GAN for non-pairing training, and emphasizes the application of After Effects and Cinema 4D in dynamic and three-dimensional graphic effects.[20]

d. Reformation of the professional course quality evaluation system, which includes interdisciplinary team evaluations from both teachers and industry designer/media to ensure a "professional data management" approach is applied. Additionally, a satisfaction questionnaire research system is also established for all professional courses related to visual communication design.

4 Future Prospects

In the face of the growing prominence of artificial intelligence, design education comes with increasing anxieties. The key to cultivating future-oriented talents is in cultivating their qualities, focusing on innovative thinking, empathy, and problem-solving. The aim is to instill in design students both artistic passion and imagination, as well as scientific rationality and logic.

The main problems faced in the teaching management and practice are grouped into the following five points[14] :

a. Maturing and refining the hybrid course model via online and offline formats;

b. Actively expanding project cooperation within artificial intelligence-aided design platforms;

c. Supporting digital and intelligent auxiliary course teaching;

d. Embracing the transformation of designers' roles in the new era;

e. Developing adaptability within faculty teams to human-computer project collaborations.

In subsequent research and practice, we aim to organize experts from the professional steering committee to provide in-depth guidance around the core goal of training application-oriented talents in the era of artificial intelligence. Further strengthening the depth and continuity of professional curriculums in cooperation between schools and enterprises is also a key focus. Finally, expanding the platform of practical teaching is necessary to improve the overall level of practical teaching[17] .

In conclusion, teaching content development revolves around the ultimate purpose of society's demand for talents. Thus, students need to understand the importance of cooperation and communication among different fields, and be open-minded to the transition from traditional basic vocational training approaches to the new application-oriented talent training mode[18] .

Acknowledgments. This article has been completed with the assistance of ten teachers from the Visual Communication Design Department at Shanghai Sanda University, a private institution. In this paper, we have chosen the advent of the artificial intelligence era as an opportunity to integrate the topic selection and technological roadmap into the curriculum and practical processes. We have also drawn conclusions from this. Finally, in the process of writing this paper, it has embodied a significant amount of preparation and progress made by our research team.

We would like to express our gratitude to the leadership of the university and the support of the university's laboratories and funding. We also appreciate the support from colleagues and leaders in the School of Information and Technology, especially for their assistance in providing interdisciplinary expertise for the artificial intelligence topic. With this support, we have been able to successfully incorporate this new design concept into the Visual Communication Design teaching system and complete this paper.

References

[1] Bautista G, Hurtado M Sanchez-Marti: Towards Smart Learning Spaces in Catalan schools: teachers' perceptions of change. Learning Environments Research, Vol. 25 (3), pp. 199-215, (2021)

[2] BENGIO Y.: Learning deep architectures for AI. Foundations and Trends in Machine Learning. Vol. 2 (1), pp. 1-7 (2009)

[3] Charteris, Smardon D, Nelson E.: Innovative learning environments and new analysis of pedagogic spaces. Educational materialism: A conjunctural Philosophy and Theory, Vol. 49 (8), pp. 808 – 821 (2017)

[4] Chen C M.: Intelligent Web-based Learning System with Personalized Learning Path Guidance.

[5] Computers & Education, Vol. 51(2), pp. 787-814 (2008)

[6] Chen C M.: Ontology-based concept map for planning a personalized learning path. Blackwell Publishing Ltd, Vol. 40 (6), pp.1028-1058 (2009)

[7] Chen Jiaying: On the Teaching Reform of Visual Communication Design Major in the New Media Era. Art Literature. Vol. 12 (2020)

[8] Dechant K.: Using systems theory to conceptualize the Dechant L. implementation of undergraduate online education in a university setting. Organization Management Journal, Vol. 7 (4), pp. 291-300 (2010)

[9] George Siemens: Connectivism: A Learning Theory for the Digital Age Instructional technology & distance learning, Vol. 2 (1), pp. 3-10 (2005)

[10] Govaerts S, Verbert K, Klerkx J: et al. Visualizing activities for selfreflection and awareness. Lecture Notes in Computer Science, Vol. 64 (83), pp. 91-100 (2010)
[11] Hamidi F , Khoshbakht M，Abdolmaleki S.: Application of reigeluth instruction design model in virtual education. Procedia Computer Science, Vol. 3, pp. 796-800 (2011)
[12] Lai C L, Hwang G J.: Effects of mobile learning time on students' conception complex problem-solving, of collaboration, communication, meta cognitive awareness and creativity. Geneva: Interscience Publishers (2014)
[13] Romiszowski, A. J.: Designing Instructional System: Decision Making in Course Planning and Curriculum Design. London: Kogan Page (1981)
[14] Shao Wenjie: Study on the Construction of Curriculum System for Cultivating Innovation Ability in Visual Communication Design: An Example of Teaching Reform in Chongqing Metropolitan College of Science and Technology. Popular Literature and Arts. Vol. 8 (2020)
[15] Wang Ping: An Analysis of the Relationship between Artificial Intelligence and Visual Communication Design Talent Cultivation. Art Technology (2018)
[16] Yang Hong, Duan Kai: The Design of Chinese Character Libraries in the Age of Artificial Intelligence. Design (2019)
[17] Yu Yan: Research on Curriculum Construction and Reform of Visual Communication Design under the Background of “Double Ten Thousand Plan”. Heilongjiang Education (Theory and Practice). Vol. 8 (2021)
[18] Zhao Qi: Exploration and Research of "Double Line" Teaching Mode in Visual Communication Design. Science and Technology Perspectives. Vol. 8 (2021)
[19] Zhu Xuejun: Visual Visualization and Information Design Curriculum Construction in the Context of Multidimensional Urban Development. Design (2019)
[20] Zou Yi: New ideas for teaching visual communication design majors in the 5G era. Da Guan. Vol. 9 (2021)