

The application of abstract think and graphic language for diagrammatic thinking in space design

Yangzi Chen^{1*}

¹ School of Art and Design, Environmental Design Department, Zhejiang Gongshang University Hangzhou College of Commerce, 311508 Tonglu, Hangzhou, China

Abstract. Environmental design as a practical major in the university, is concentrating on training students to become professional designers to fit the requirements of the design market today. Traditional design education that only construction documents with CAD technology training has no longer satisfied the needs of economy and the market today, so we have to explore new strategy to change the way of teaching. This article explores some examples of new strategy of how to set up lecture, studio practices, and competition workshop for environmental design course system in high education institute in China. The goal is to transform abstractive thinking in art and design perception to representational diagram in visual technique. We hope this new exploration can reform the atmosphere during studio education, with merging new technique such as new digital media, AI and IT technology, and therefore, change the learning technique and improve students to learn more. **Keywords:** abstractive think, concept diagram, graphic language, visual technique, exploration.

1 Introduction

Concept design is one of the most common strategy to approach space design. Space design usually include residential space, commercial space, and public space design[1]. Concept diagram, creative thinking, is a basic tool supporting teaching in environmental design in most universities in China. It is a reform of the curriculum and strategy of environmental design, based on the characteristics of environmental design - that is, the particularity of the close connection between space design thinking and professional practice, and the specific of basic teaching content - mainly to train students' software modeling skill and spatial imagination skill, to incorporate the subject of graphic thinking into the teaching curriculum of space design. This article has list potential of concept design and diagrammatic thinking, the basic teaching strategy in the environmental design major. The curriculum new exploration, based on the strategy, organically combine spatial thinking and practical design, improving students' professional skills, so that the purpose of environmental design education can be achieved.

2 Abstract think and graphic language are necessary tools for environmental design

Abstract think refers to the form of thinking used by people when understanding and processing abstract concepts such as design concepts and principles. It is

one of the thinking strategies that transcends specific ideas[2]. It can abstract away the various details, hold the essence and commonalities, and then form general concepts and regulation. Abstract think is very important in many fields such as mathematics, logic, philosophy, science, and other fields. It can help people discover the regulation and essence[5]. In the fields of modern science, technology and economy, abstract think is also a very important strategy that can carry out efficient problem solving, innovation and decision-making[5].

Graphical language uses visual elements such as graphics, symbols, icons, to represent information and perception. Its purpose is to make complex information visible and be ready for communicating, while also being able to cross language and cultural barriers. Graphical language is often used in fields such as technology, design, education, and transportation, as well as in communicating information to the public, such as illustrated instruction, map, and sign. Common graphic languages include flow charts, brain storm mapping, organizational charts, geographic map, logo, and dynamic diagram[6].

Diagrammatic abstraction had already become instrumental to architectural theory and history in the eighteenth century, long before the modern discourse on the diagram was consolidated in the 1990s[8]. Abstract think is one of basic thinking strategies in art and design field that connects with graphic language. Many students have the ability to complicate simplicity, but they are lack of the training to simplify complexity. Abstract think is the ability to integrate fragments into

* Corresponding author: yangzi.chen@zjhzc.edu.cn

integration. We will use concepts, inference, prediction and other forms of thinking to have a closer understanding to the essence of objects. Therefore, this ability will play an important role in spatial analysis.

Concept diagram is not simple analysis diagram, nor is it a large number of overlays, but a pictorial language that can reveal the essence of a building or city. Therefore, diagrams can succinctly express environmental characteristics, spatial organization, architectural imagery, or generative logic. It is an expression tool for abstract think.

3 Teaching reformation through graphic language training is an important way to train design thinking

3.1 Premise

Explain illustrated cases in the course and emphasize the importance of analytical thinking to design.

The architectural diagram is regularly explained as a generic and generative description, it can equally be defined as a typological diagram specific to the architectural discipline and its production of knowledge[8]. Graphic thinking is the ability to transform literal language and abstraction into graphic language[3,4]. Students can express what they learned, and project research results in the form of illustration and diagram. In the past, book text, lecture text as the main narrative provided a detailed interpretation, but lacked intuitive visual experience, which increased the difficulty of understanding. It is hardly to convert textual concepts into knowledge suitable for graphic expression in short time. Expressing design language more suitable for visual effects, using concept diagram, will change the traditional course teaching mode. These design diagram do not merely communicate what already exists, but provide a method of discovery, experiment and creative invention[9].

3.2 Core

Effectively integrating the content of the curriculum system and making extensive use of graphic language throughout teaching.

Space design courses such as residential space design and public space design usually introduce common examples and display a series of cases. Rather than general, non-targeted presentations and large amounts of textual theoretical explanations, the program features or special materials of each case are presented in the form of suitable detailed pictures or analytical diagrams that conform to the concept. It is not limited to floor plan and section drawings. Plans, cross-sections, and physical photos of the final completed space are also included, as well as a large amount of conceptual element analysis and design details. Through a large number of targeted case pictures and detailed explanations of graphic expressions, the impact of changes in architectural details on spatial design is emphasized. Select the corresponding text concept and

combine the picture information to explain. This approach can avoid the problem of asymmetry between textual description and display of information during the lecture, making the way of explaining design logic and program design intuitive and concrete[7]. For most students, detailed picture information is very intuitive and plays a self-evident role in visual understanding.

3.3 Key

Deconstructing design logic and design regulation is an important teaching practice strategy.

The teaching of space design courses can be finally classified into several important knowledge categories based on the experience of preliminary research and project practice. These are the five main directions: site analysis, human activities, user positioning, element extraction, and spatial concept illustration. Starting from each topic, the words that come up from the preliminary research and thinking explosion are used to show the personal understanding of the design issues and the summary of the data collection in the form of hand drawing or computer graphics. Traditional teaching is dominated by construction drawings and drawing specifications for program demonstrations, which tends to unconsciously weaken the deduction of the design process during teaching. Many students have no construction experience and have difficulty understanding construction drawings.

Site analysis - summary of site analysis combined with mapping. Site analysis is no longer just an ordinary list of site information, but a summary and integration of site human factors and environmental factors through graphic expression. Human factors include man-made infrastructure - walls, railings, stations, courtyards, historical areas ; traffic lines - people flow direction and activity forms ;site perception - noise, smell, smoke, pollution ; human factors - the scope of human activities on the site and path. Environmental factors include the surrounding environment of the site - the surrounding existing building conditions, existing paths, existing landmarks, existing nodes ; the actual situation of the base - base traffic, direction of people flow, regional location, ; natural vegetation and terrain - terrain conditions and contours, vegetation conditions ; climate - solar altitude angle, rainfall/snow amount, humidity, and temperature. During site research, students are encouraged to search complete site information, strive to discover the practical problems that they want to solve, explore the relationship between site factors and design features, and conduct site information related to design plans. Students are required to summarize information, and present them in the form of graphic language marked on a map.

Human activities - in a specific space and within a specific site, human activities may have different targets. In the catering space, human activities can be divided into guest activities and catering servants activities. We can find that human activities such as ordering, dining, talking, service, and other common types of activities in catering spaces; while office activities, meetings, receptions, negotiations, and other types of activities are common activities in office spaces. Based on the

definitions of different space properties, it can be inferred what types of behavioral characteristics or psychological needs people have in different types of spaces. Transforming space according to people's needs is one of the very popular topics today. Presenting these activities in the form of images and adding text descriptions makes the content of the preliminary research more visually targeted[8].

User targeting - we can use simple image information to highlight the core parts that users require most. When conducting customer analysis, in addition to recording the customer's design requirements and preferences in words, the customer's specific needs can be divided and summarized in the form of charts.

Element extraction - element extraction in space design is not just about extracting forms from nature or art works, but using abstraction, structure, and reconstruction to conduct a series of morphological analyzes of inspiration objects, and evolve new ideas from them. As design language and basic spatial form, element extraction can achieve the goal of design aesthetics.

Space Concept Illustration - the space design derivation process that summarizes all the above contents. It is not just simple shapes and images, but based on the site environment and event marks of each different project, activities are integrated into the space, and artistic beauty is integrated into the craftsmanship. This series of spatial illustrations is not limited to one possibility, each possibility has a design logic based on the above content.

4 Course cases

4.1 Independent house renovation in Pingyao Town

Pingyao Town is located in Liangzhu area, Yuhang District, Hangzhou, the site of the ancient Liangzhu culture. The local old streets have been renovated and still retain the style of the 1970s and 1980s. Today, various commercial stores and intangible cultural heritage museum are located in this ancient town. Sericulture Cultural Museum, Liangzhu Jade Carving Museum, Yuhang Paper Umbrella Museum, Pingyao Ceramics Museum, and Kite Lantern Museum are popular among the local residents. The block façade has been renovated, with large grey brick material. The students research teams started from the essence of the design, discovered problems, and captured the connection between the Pingyao Town neighborhood and the residential area in the back mountain. Each research group chose one customer type, and conducted detailed customer demand research, including the user's role in society, personality, interests and hobbies, and the needs derived therefrom. For example, one of the customers was an artist, with a personality often needs coffee to refresh himself while working. In this house renovation project, a staircase leading to a coffee shop next to the venue would be specially designed in the house to make it easier for him to buy coffee and go upstairs. The other example, in the house for an

Youtuber who especially liked to introduce how to cook delicious food, the kitchen space would be expanded in the renovation project. The course project does not formulate specific customer needs, but only gives the customer's identity type, so that students have enough freedom to imagine various possibilities related to users' role identity, to imagine and figure out what is this identity's characteristics and needs, that is, each project team can fully represent their most particular project due to different customer types and needs. Meanwhile, students are trained to use graphic language to tell and express customer needs, which provides a foundation for the potential possibilities of the design concept.

4.2 Multifunctional public space complex design

The functions and objectives of public space design often play a decisive role in architecture and interior design. Elements such as the population, land use type, and frequency of use must be considered. Students are required to design a multi-functional space based on their understanding of public space, properly plan activities and circulation lines in the space, ensure space usage efficiency and a human environment, including consideration of sustainability elements and create a pleasant indoor and outdoor atmosphere. Students research team can choose the type of public space, find suitable urban sites.

No matter what type of public space is chosen, students have sufficient freedom to assign various activities inside the space, starting from the spatial section through sight analysis, lighting, wind direction, and streamline analysis diagrams, which is starting with several small spatial cross-section narratives, presenting them in diagrammatic form, and eventually organizing all the narrative drawings.

5 Interaction and discussion can lay the foundation for teaching improvement

Lectures are considered to be integrated with multimedia. According to students' personal thinking and existing knowledge reserved, design ideas are expanded and guided from multiple perspectives. The addition of multimedia can activate the class atmosphere, and increase the channels for imparting knowledge[9]. Video and audio can be used to deepen students' understanding of specific knowledge points. This plays a role in stimulating enthusiasm in class.

5.1 Interactive discussion can promote mutual influence and penetration between instructors and students

During the desk-critics and case explanations, instructors and students in the research group conduct deep interactive discussions to penetrate design ideas and thinking habits, and promote mutual learning and communication between instructors and students[10]. Traditional course teaching is mainly based on lectures in large classroom, which lacks the interaction and

attention. Conducting interactive discussions with students during the key steps may remind instructors to not ignore students who are introverted and have specific questions.

5.2 Continuous thinking and discovering problem can improve the quality of teaching

Interactive discussions between teachers and students can help teachers find questions, and find out what problems to solve, use which strategy to solve, and how these are connected. The final assignment is evaluated by each team member, that conducive to cultivate students' team spirit and collaboration skills, as they can learn from each other.

Environmental design is a subject that comprise practical experiences than theoretical learning. In addition to clarify teaching objectives, it is very important to use strategy that comply with design guidelines, at the same time, an environment with a diverse support system must be created for students. After class, instructors can set up questionnaires to provide feedback and organize students' opinions and questions, so as to improve future course settings.

6 Conclusion

In the 21st century, the market system has been improved, and various conditions for new business opportunities are created. The diversified society and market system encourages people to innovate, and requires faster and more convenient services. Many design fields have already invested in the use of AI. In order to not be replaced by AI in the future design industry, I think it is particularly important for designers to master comprehensive design thinking strategy.

The training to understand the abstract thinking of diagrams is not achieved soon, nor can the understanding of conceptual diagram language be fully penetrated in a short period of time. By deconstructing the graphic language and collecting, summarizing, and reorganizing data from different fields, students can establish their own design logic and design language. Designers need a certain amount of practical experience and time to establish construction of design. School training can be used as inspirational education, deeply implanted in students' consciousness, and play a fundamental role in future practical projects.

The teaching of environmental design still needs more novel strategy to integrate traditional teaching, and the educators in environmental design also need to continue to explore, learn and innovate in the teaching process.

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