



Research on Information-based Teaching in Reform and Practice of Architectural Design

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Received 23 September 2016 • Revised 12 February 2017 • Accepted 17 February 2017

ABSTRACT

In China, with the development of the era, the Architectural Design (AD) education has been given the requirement that students should master creative thinking mode and design method. The teaching target of integrating the Information-Based Teaching (IBT) into Creative Thinking (CT) mode is analyzed, and the Teaching Mode (TM) of integrating the information-based teaching into architectural design is constructed in order to achieve the goal of teaching reform to cultivate creative thinking mode and design method, moreover, the results of teaching reform is also carried out with analysis of teaching quality, hoping to provide reference for the education of architectural design.

Keywords: architectural design (AD), information-based teaching (IBT), creative thinking (CT), teaching mode (TM)

INTRODUCTION

With the demand for rapid development of construction and the requirements of specialization and diversification of architectural design talents, engineering and technical personnel of general and compound types have become the new social needs, which requires the architectural education to cultivate the talents who not only can make drawing but also own creative thinking mode and design method at the same time. With improvement of information technology, the information-based teaching achievements that meet the current social demand for architectural talents with greater sense of the times, have been applied to architectural design teaching to construct new teaching mode supported by information technology, and improve the learning efficiency and the design thinking of students taught with contents of more abundant multidisciplinary integration, thus breaking the traditional teaching method of trial and error design of architectural scheme, which is worthy of promotion (Wang, 2012).

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State of the literature

- Engineering and technical personnel of general and compound types have become the new social needs.
- The traditional teaching modes of architectural design are far from being able to meet the new goal of architectural design teaching.
- The students was imprisoned by closed system in personal thought, or limited to single traditional teaching of teacher-student dialogue, which would seriously hinder the diffusion and the development of students' design thinking and was not conducive to the exchange and the training of students' design thinking.

Contribution of this paper to the literature

- The significance of the present study lies in its contribution to the literature with cultivation of creative thinking mode and design method, and carry out communication of thinking in open education to diffuse students' thinking and inspire design inspiration.
- According to the study, the teaching mode of integrating information-based teaching into architectural design were proposed.
- The results of this study shows that is very suitable for architecture education with characteristics of large amount of information and graphics by network aided teaching mode and information technology, at the same time, information-based teaching promote the further improvement of teachers' knowledge structure and innovation ability.

The information technology teaching refers to the teaching activity that educators and learners in information environment use information technology and new method of modern educational media to share educational information resources, which is based on students' learning with the cultivation of students' learning skills as a means to cultivate students' learning interest, realize self-directed learning, and achieve good teaching results through the organic integration of information technology in each step and element of teaching process (Hill & Hannafin, 2001 ; Kalay, 2006 ; Kim & Lee, 2016).

TEACHING TARGET OF INTEGRATING INFORMATION-BASED TEACHING INTO CREATIVE THINKING MODE

First target: Cultivation of creative thinking mode and design method

Based on years of tracking of students' qualities evaluation, the current general problems of the students of architectural design can be concluded as follows: Immature view of architecture, inaccurate spatial sense, unskilled hand-painted techniques, unsound theoretical knowledge, etc., while the architecture requires strong practical ability and the accumulation of months and years pass by. The traditional teaching modes of architectural design in the past such as the cramming teaching method, the disconnection between theory and practice, the assessment method based on given score, and paying more attention to result than process, which are far from being able to meet the new goal of architectural design teaching. Students' creative thinking mode and design method are cultivated through the

multifaceted guidance in the interacted way and the integration of information technology in forms of digital audio-visual materials, multimedia teaching software, electronic publications and others, while on the one hand, the graphic expression is strengthened to enhance image thinking through a case study; on the other hand the various question situations are created to inspire divergent thinking; the cultivation of creative thinking is combined with the information-based teaching through the means of developing lateral thinking, designing related knowledge accumulation by the introductions of special lectures, technical regulations and so on, thus not only breaking the shortcomings of traditional architectural design education, but also promoting the optimal development of students' abilities (Li, 2000).

Second target: Carry out communication of thinking in open education to diffuse students' thinking and inspire design inspiration.

The open environment is the basic condition of creative education, which is also no exception for architectural design education. The students cannot be imprisoned by closed system in personal thought, or be limited to single traditional teaching of teacher-student dialogue, which will seriously hinder the diffusion and the development of students' design thinking and is not conducive to the exchange and the training of students' design thinking. Through the information teaching methods, offer case study to report the findings for communication by making task book so as to give the platform to students; promote the students to generate resultant effect and complementary effect on architectural design and creation through the staged exhibition of works, resulting in unusually active communication of students' thoughts. In the communication, the students realize that the learning of architectural design is a process of training thinking, mastering the method and cultivating the ability (Hao & Xiao, 2016).

TEACHING MODE OF INTEGRATING INFORMATION-BASED TEACHING INTO ARCHITECTURAL DESIGN

1. Interactive guidance for case study in the early stage of design

Interactive guidance in the early stage of design can not only enable students to quickly enter the role of architectural design, activate the design thinking, but also enable students to have an intuitive understanding of the content and the depth of architectural design.

There have been some outstanding cases of guiding students to learn, which can enhance students' perceptual knowledge of the type of architecture to be designed and enable students to quickly understand the specific content of the design topic so as to avoid students from having no idea of the design task book in the early stage of design. Teachers provide specific topics to guide the students to participate in group discussion and form opinions through field research, network research, written research and other ways, especially for the typical cases of well-known buildings, whose design methods should be analyzed to summarize and conclude the mode of design thinking based on the discussions about design thinking and solutions to problems, while this part can be carried out with case study to expand space time of teaching, and realize the open and interactive teaching by using drawing

language, multimedia teaching, network interaction and communication, in order to achieve the cultivation of creative thinking.

2. Alternate interaction between special lectures, technical regulations and actual projects in the design

The design process will be integrated through the creation of special lectures, the knowledge support of relevant technical regulations and the introduction of actual project so as to not only train the students' design thinking methods but also activate the students' design thinking.

—Special lectures. The students' sense of the actual spatial scale, the users' psychological feeling when walking in the middle of the building, the coordination on site between architecture and environment, even how to inherit the cultural traditions, etc., all the above aspects are lack of proper design experience. The introduction of special lectures can be used to enhance students' thinking experience with inspiration and help. According to the problems reflected by the students, the teacher can carry out the online video live at the appointed time, and the students can watch the video online and ask questions online, thus realizing the remote real-time interactive "teaching" and "learning".

—Knowledge support of relevant technical regulations. The feasibility of architectural design ultimately relies on the support of relevant architectural technical regulations. In the current teaching system of architectural design, the integrations of architectural design and technical regulations relating to architectural physics and equipment, building materials, building structure, construction and other related systems are not enough, while many students had to abandon their good designs due to the question that "whether it can be built or not", which undoubtedly affected the students' creating enthusiasm and interest in design. Guide the students to use technology of building information model (referred to as BIM) based on network cooperative work, not only for the architectural design, but also for structural design, equipment management, statistics of engineering quantity, cost calculation, property management and so on, which can realize the integration of building information, and promote information exchange and sharing in order to improve the architectural design, construction and operation management efficiency. The new design concept has fundamentally changed the teaching methods of architectural design, and opened up new possibilities for the information education of architecture. At present, BIM and its applications, collaborative design in architecture, visualization of virtual technology and architecture, computer-aided analysis and simulation of building environment, etc., are increasingly becoming hot issues in research and teaching. The introduction of BIM technology in digital teaching in colleges and universities can be described as a general trend (Song, 2015; Li, 2014; Wang, 2010).

—Introduction of actual project. Students' learning of design at school mostly focuses on theorization and idealization with stereotyped design topics (hotels, schools, libraries, bus stations, etc.). In this way, students could not really grasp the design procedures of practical

engineering through the designing study, and they also learn little knowledge of dealing with the owners and cooperating with various specialties. The actual projects are introduced into the design through the multimedia display technology to show the site analysis, design and construction, construction management and other aspects, which can not only broaden the horizons of students, but also stimulate the students' learning interest. Moreover, it is conducive to not only cultivating the cooperation and professionalism of architects but also keeping abreast of new industry standards, new materials and new technologies, thus making the teaching of design be extended and expanded in practice (Xiao & Hao, 2014; Hao & Xiao, 2011).

3. Staged exhibition review of designing results, integration of communication and team spirit (Wang & Yu, 2013), combination with digital information management

Evaluation of design results is an important link to promote the exchange of ideas, making the designing thinking be diffused in student-student and student-teacher communication through the staged exhibition of works and the establishment of digital operation platform. The links including the input of electronic work into digital platform and indoor exhibition of paper work are added at the end of each stage of the design so that the students have the opportunity to browse the programs of their classmates on digital platform, introduce their own programs in outdoor exhibition to illustrate their own design ideas, and also respond to questions and evaluation of students and teachers. This open digital teaching platform and the teaching links including outdoor exhibition and interaction, not only create the active classroom atmosphere, but also increase students' learning motivation, and cultivate the student's abilities of program presentation and language expression.

It should pay more attention to the change of teachers' role in the course of design communication in order to create a harmonious teaching environment that "teaching is learning". The role of the teacher is to guide rather than regulating the students. The teacher should be the adviser rather than the mentor to discuss with students the problems in the design, provide students with reference information, help students in the bottleneck stage of design, cultivate the students' habits of solving difficulties in the design to choose the best solution, and ultimately enable students to stimulate interest in design so as to improve self-confidence and complete the design task (Xiao & Hao, 2014).

4. Teaching and resource sharing to facilitate the interaction and communication between teachers and students

Teachers should break the traditional closed situation and communicate with each other in order to realize the interaction between curricula system by using interactive software platform, while on the one hand it can strengthen the effective cooperation between teachers, on the other hand it can promote the integration and improvement of every teacher in teaching philosophy and teaching level to realize dominance interaction, which is helpful to improve the quality of teaching.

Table 1. The Evaluation and analysis on teaching innovation by students

Evaluation items	Evaluation results (%)			
	Excellent	Good	Average	Pass
Reform of teaching methods	73.0	17.7	9.3	0
The use of Information-based teaching to help learning	54.2	32.7	11.5	1.6
Improving the design ability by information-based teaching	59.3	38.5	2.2	0
Ability to use information technology to acquire and process information	4.7	36.0	40.7	2.3

Based on the interactive mode of educational informationization, students can obtain the relevant learning resources on the software platform from various curriculum-related teaching materials including lecture notes, case data, students' work, etc. In addition, answering online can be achieved, which means that the students can get timely answers to their questions so as to realize teacher-student interaction. The teaching management department also can carry out real-time monitoring and evaluation of the teacher-student communication through the interactive software platform, which will be fed back to the academic affairs office or the student management department, in order to facilitate the relevant departments to formulate relevant policies and methods, thus promoting the improvement of teaching quality (Liu, 2010; Liu, 2009).

EFFECT ANALYSIS OF TEACHING REFORM

After years of teaching reform, the practice has proved that the teaching reform mode with integration of information-based teaching in teaching design has improved the teaching quality, resulting in significant effect of teaching reform in creative thinking mode and design method with the integration of information-based teaching in architectural design, which is well received by students. The proportion of students with excellent achievements has shown with an upward trend year by year, the proportion of good students has been significantly improved, and the proportion of qualified students has been reduced year by year. The students' interest in learning is greatly enhanced with the increase in their learning autonomy, as shown in **Table 1**.

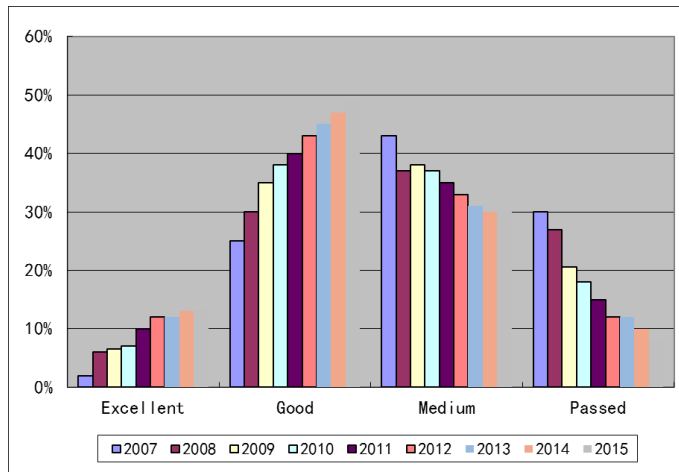


Figure 1. The overall quality of students

Through the teaching reform, more students consciously have begun to use creative thinking mode and ability to integrate learning concepts in the design process, thus improving the comprehensive quality of the students. At present, the goal of teaching reform has been achieved with good development trend, as shown in [Figure 1](#).

CONCLUSION AND RECOMMENDATION

The demand for architectural design professionals has mainly focused on the application with diversification and integration of social development, at the same time, the computer-aided application and information network acquisition of knowledge in design industry have both brought new development opportunities to the architectural design education. Network aided teaching mode of combining architectural design curriculum with information technology, is very suitable for architecture with characteristics of large amount of information and graphics, who's teaching effect reflected by students is better than the traditional teaching mode. At the same time, information-based teaching has also put forward higher requirements to the teachers with challenges to teachers' quality, knowledge reserve and comprehensive ability, thus promoting the further improvement of teachers' knowledge structure and innovation ability. Therefore, the cultivation mode of integrating information-based teaching in architectural design teaching should be adopted to cultivate architectural design talents, which emphasizes the high integration of curriculum and informationization to actively mobilize students' learning autonomy and improve students' creative thinking ability. This is beneficial for the cultivation of applied talents, which is the innovation of this teaching reform.

ACKNOWLEDGEMENTS

The authors acknowledge the financial supports by Key Scientific Research Projects in Colleges and Universities of Henan in 2016, Research on Teaching Reform and Practice of

Architectural Design Based on Educational Informationization in Junior Grade (16A880007); the Start-up Project for High-level Talented Person of North China University of Water Resources and Electric (Li-Jun Hao, 200611007; Zhe-Tao Xiao); Power Humanities-Society Scientific Research Program of Henan Province Education Department, Research on Pattern of Green Space Network from Perspective of Ecological Zhengzhou GIS (2017-ZDJH-121).

REFERENCES

- Hill, J. R., & Hannafin, M. J. (2001). Teaching and learning in digital environments: The resurgence of resource-based learning. *Educational Technology Research and Development*, 49(3), 37-52.
- Hao, L., & Xiao, Z. (2011). Teaching Reform and Thinking of Architectural Design Course. *Journal of North China University of Water Resources and Electric Power (Social Sciences Edition)*, 1, 186-188.
- Hao, L., & Xiao, Z. (2016). Reform and Practice of the Teaching Mode of Architectural Design. *Journal of Residuals Science & Technology*, 13(6).
- Kim, S., & Lee, H. (2016). Visitor attention and communication in information-based exhibitions. *International Journal of Design*, 10(2).
- Kalay, Y. E. (2006). The impact of information technology on design methods, products and practices. *Design Studies*, 27(3), 357-380.
- Liu, X. (2010). Instructional Design of Architectural Design Course under Network Environment. *Journal of Xuzhou Institute of Architectural Technology*, 10(1), 56-58.
- Liu, X. (2009). Discussion on the Educational Reformation of Architecture Design Courses' Network Aided Teaching. *Journal of Shenyang Jianzhu University (Social Science)*, 11(3), 375-378.
- Song, Y. (2015). The Application of Information Teaching Design Achievements in the Teaching of Architecture Specialty. *Sichuan Cement*, 4, 303-303.
- Wang, H. (2010). Problems Existed in Teaching Informationalization of Vocational Education Curriculum and the Countermeasures. *Vocational and Technical Education*, 32, 54-55.
- Wang, B. (2012). The Training of Creative Thinking in the Basic Education of Architectural Design. *Packaging World*, 2, 52-53.
- Wang, H., & Yu, X. (2013). Teaching Reform and Practice of Architectural Design Series Courses Based on Ability Training. *Education and Vocation*, 18, 128-130.
- Xiao, Z., & Hao, L. (2014). Nine Points Design—Study on the Teaching Model of the Architectural Design for the junior in Colleges. *Zhejiang Construction*, 31(8), 60-63.
- Xiao, Z., & Hao, L. (2014). Innovation Research of Teaching Links about Low-Grade Architectural Design. *Anhui Architecture*, 4, 54-54.

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