

# Research Progress of Online Teaching Application in Architecture Education in China

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**Abstract.** Under the background of "Internet+Education" and COVID-19, online teaching has become the focus of higher education practitioners and administrators. Through literature research, this paper systematically reviews the research progress in applying online teaching methods in architecture education in China in the last ten years. This paper expounds on the research stages, research hotspots and application modes of online teaching in architecture education to provide a reference for online teaching in architecture education in China.

**Keywords:** Online teaching; Network classroom; Education of architecture ;Teaching mode.

## 1. Introduction

Since the Ministry of Education issued the Ten-Year Development Plan of Educational Informatization (2011-2020), after ten years of development, the mode of "Internet+education" has become one of the critical modes in contemporary education, and the online teaching method has attracted more and more attention of scholars. Online teaching refers to providing education by using the Internet or other mobile devices as media. Its primary forms are asynchronous online teachings, such as micro-courses and massive open online courses synchronous online teaching.

Since 2020, to ensure the regular operation of teaching work under the new epidemic of coronary pneumonia, colleges and universities across the country have started to use online classrooms for daily teaching work on a large scale, and the application scale of online teaching methods has surged. Currently, some progress has been made in the application research of online teaching in architecture education in China. Therefore, this paper reviews the existing achievements from the aspect of teaching mode and puts forward the follow-up development direction to promote the research process in this field and provide guidance for online teaching practice in architecture education.

## 2. Literature Retrieval and Screening

With the keywords "online", "teaching", and "architecture" as the primary search conditions, China Journal Database, China Doctoral Thesis Database and China Master Thesis Database in the CNKI database were searched. For articles published from 2011 to 2021, retrieved 1,269, and all the keywords were in Table 1. According to the number of published articles, analyzed the research stage. The retrieved papers were evaluated for quality and relevance, and 107 were selected. Firstly, all the selected articles are analyzed. Then, 54 papers were selected to study the teaching reform of architecture in the undergraduate stage, and the application mode of online teaching was determined according to the research hotspots. The results of each study will be discussed in detail in the following paragraphs.

Table 1 Chinese key words used in CNKI database

On-line	Architecture	Teaching
online, network, internet, cloud	structure	education, learning, classroom, curriculum

### 3. Research Status of Application of Online Teaching

#### 3.1 Analysis of research class

From 2011 to 2021, the number of research papers on online teaching methods in architecture education has changed dramatically. As shown in Figure 1, it can be summarized into two development stages, the initial budding period (2011-2017) and the rapid development period (2017-2021).

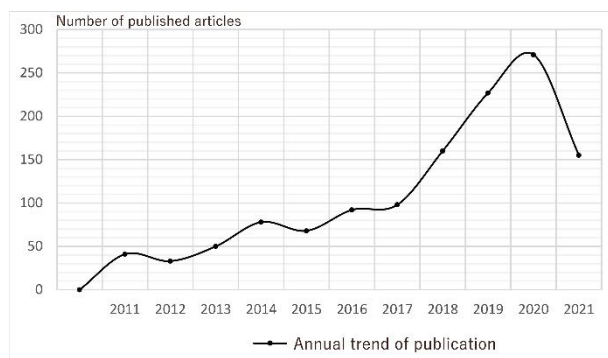


Fig. 1 The trend of online teaching-related articles in architecture education from 2011 to 2021

The "Ten-Year Development Plan for Education Informatization (2011-2020)" issued by the Ministry of Education proposes to build an information-based learning environment where people should enjoy high-quality educational resources. Therefore, online teaching has become popular. It began to attract the attention of scholars. There is a vast difference between online teaching and traditional teaching mode. Although DA Cook et al.'s research shows that compared with traditional teaching models, online teaching can break the time and space constraints of students' learning with lower cost and the same effect as traditional teaching. However, at this time, teachers and students majoring in architecture in China have yet to be widely exposed to online teaching. During the seven years from 2011 to 2017, the development of online teaching was in its infancy. It is characterized by relatively slow development, with a total of 457 related documents. From 2017 to 2021, online teaching is in a period of rapid development, with a total of 812 articles, and the number of articles has doubled compared with the previous seven years.

On the one hand, with the support of national policies, the Ministry of Education issued the Opinions on Strengthening the Construction, Application and Management of Online Open Courses in Colleges and Universities in 2015, proposing to promote the broad application of online open courses, thus promoting the improvement of online teaching. On the other hand, to prevent and control the epidemic in China in 2020, teachers began to adopt online teaching on a large scale, and online teaching activities surged. Scholars' research on teaching mode, online teaching platform, assessment and teaching effect also increased accordingly. In 2021, China entered the "post-epidemic" era, and education and teaching need to switch between offline and online teaching at any time, according to the epidemic situation. In this context, the hybrid teaching mode combining online and offline has become the key direction of subsequent reform. As a result, the number of articles that focus solely on online teaching begins to decline.

#### 3.2 Analysis of research hotspots

A total of 107 papers were selected by quality and topic relevance, including 56 papers in the undergraduate stage and 51 in the higher vocational stage. Because of the different goals and concerns of talent education between higher vocational education and undergraduate education, this paper mainly discusses the research hotspots of 56 articles in undergraduate education. Professional architecture courses can be roughly divided into professional theory courses, professional design courses and professional experiment courses according to their characteristics. In related research

around theory courses, examples of reform are often found in architectural history and computer-aided design courses.

In addition, the keywords of the literature will reflect the theme of the article. High-frequency keywords can reflect academic research hotspots in a period. From 2011 to 2021, the keywords and their frequency of online teaching research in architecture undergraduate education in China are shown in Figure 3. As can be seen from Figure 3, the most prominent research hotspot of online teaching is the teaching mode, followed by teaching reform and teaching platforms. Therefore, this paper mainly discusses the research results related to teaching mode.

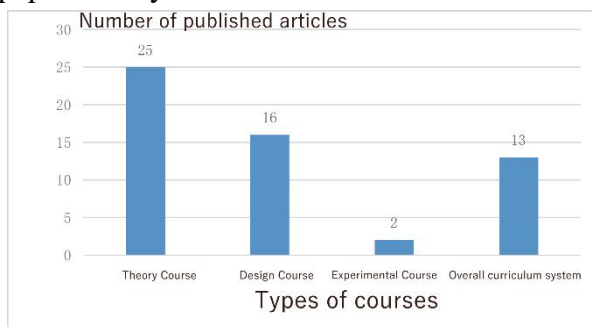


Fig. 2 The number of articles issued by various courses in architecture education from 2011 to 2021

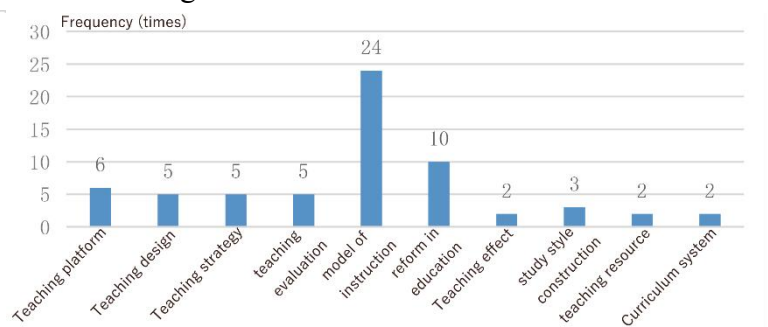


Fig. 3 Keywords Frequency of Online Teaching in Architecture Education from 2011 to 2021

## 4. Application mode of undergraduate online teaching

### 4.1 Construction of the overall curriculum system

There are apparent differences between architecture and other science and engineering disciplines. The core curriculum group of the architecture major is composed of a series of courses in a unique architectural design. Knowledge courses and practical courses are additional courses. It aims to help students build a complete professional ability of architects. Xin Pan et al. [1] put forward an online course system called "one subject and six modules", which takes the design course as the core and combines theoretical and practical courses. The specific contents of design courses include teaching courseware, excellent architectural works, case appreciation and standard. Theoretical course modules include lesson plans, chapter courseware, comprehensive training items and examination review contents. Its starting sequence is consistent with the theme of design courses. The modules in related fields of architecture, such as interior design principles and urban planning, mainly include teaching plans and courseware. The design module includes hand-drawn expression, computer software applications, hand-drawn training and software operation video. The practice module includes the practice teaching content and the process evaluation system. With the support of this system, teachers can know the teaching contents of other courses at any time and assign homework in combination with significant design courses, which helps students to understand the relevance of knowledge among different courses.

Wang Zhen et al. [2] Proposed a teaching method combining multiple teaching platforms, entirely using the advantages of different platforms for different types of courses. This teaching method prepares for long-term and flexible online teaching in the "post-epidemic era". Wu Shanglin et al. [3] investigated the Internet education products of architecture. They found that the software learning courses in the comprehensive architecture education websites occupy a significant position in the whole curriculum system. For example, the software learning courses in a network account for more than 60%. The above phenomenon reflects the learning needs of students for software. However, as we all know, online software education courses must combine learning and practice to achieve good results. Therefore, we should introduce Internet education products into the architecture undergraduate education curriculum system in sections according to the teaching objectives in our daily teaching.

All the above studies show that we need to understand online teaching as the networking of traditional teaching. We should integrate curriculum resources and strengthen the connection between knowledge points during the construction of online teaching. Finally, we need to form a teaching curriculum system with a strong correlation between knowledge points and ability training. In addition, there are differences in the specific teaching modes of each kind of course. Therefore, the following is a summary of the research results of the online teaching mode of design courses and theory courses at the undergraduate level.

## **4.2 Application of theoretical courses**

### **4.2.1 Micro-lesson**

David Penrose formally put forward the concept of micro-course in 2008 and applied it to online courses [4]. The online micro-course is characterized by thematic solid and targeted knowledge points and focuses on solving the complex and error-prone points in the course. According to the needs of teaching, knowledge can be fragmented and miniaturized, and then it can be given to students in a targeted way. However, at present, most micro-lesson platforms lack interactivity. At the same time, only some architectural teaching modes use micro-courses and do not carry out offline teaching. Niu et al. [5] proposed that micro-courses can be organized into thematic knowledge indexes, and fragmented knowledge can be connected in series according to categories. For example, the knowledge framework of architecture digital technology micro-classroom can be divided according to the training objectives of architecture design courses so that the theory and design courses can be closely combined. This model provides students with learning navigation, enabling them to customize their learning plans according to their abilities.

### **4.2.2 SPOC hybrid teaching mode**

The concept of SPOC was first put forward and used by Professor Armand Fox of the University of California. There are two main modes of SPOC teaching. One is to implement flipped classroom teaching directly in the university campus classroom combined with massive online open courses. The other is to select about 500 applicants from all over the world to be included in the SPOC course. Xiao Qing et al. [6] used the SPOC mode to teach Digital Technologies of Architecture. Before class, the group task was released by app, and the group leader responsibility system was adopted. Students completed homework and data recording tasks in groups, and the photos of the implementation process were sent back to the instructor through QQ. In class, multimedia is used to teach the main points of the course. Students independently draw and report the homework before class, and students become the main body of the class. After class, use the APP to submit homework and answer questions. Compared with traditional teaching, this teaching mode improves students' critical thinking ability and cultivates students' ability of active thinking, communication and expression, and integrate theory with practice.

## **4.3 Application of design courses**

As the core course of the architecture major, the design course relies on face-to-face presentation and interaction between teachers and students. When online teaching reform of such courses is carried out, we must pay attention to whether the interaction of teaching organizations can meet the demand. Hou Shuai et al. [7] conducted teaching experiments and feedback evaluation surveys on three online teaching organizational forms: conference discussion, report feedback and screen recording annotation. Data analysis showed that the satisfaction of conference discussion was the highest, while that of screen recording annotation was the lowest. The overall evaluation shows that students' acceptance of online teaching of design courses is good. However, by analyzing the preference differences between male and female students or high and low-grade students, it is also found that different groups of students have different preferences for teaching organization. Therefore, it is suggested that teachers try their best to organize different teaching forms in different teaching situations based on the analysis of their learning situation. This kind of teaching

experiment can guide teachers to improve teaching organization. Xue Yun et al. [8] adopted the interactive teaching mode. Before teaching, students were inspired to seek knowledge in advance through the resource platform, and then teachers and students answered and analyzed the design tasks through the online interactive platform. In the initial design stage, the design concept is completed by online centralized theory teaching and online group counselling. In the mid-term design stage, group discussion and communication, centralized report, remote instruction and answer by design institute engineers and other university scholars and experts are used to guide students to improve the design scheme. At the end of the design stage, the results will be defended and evaluated through online reporting and drawing evaluation. This interactive online teaching enables engineers and off-campus scholars of design institutes to break the limitation of space and time, participate in classroom teaching in a diversified way, and stimulate students' learning autonomy.

## 5. Discussion

As mentioned above, it is still in the exploratory stage after the rapid development of online teaching in architecture teaching in China. There are still some imperfections in the actual construction of the curriculum system. For example, the problem of enhancing the interaction of teaching organizations based on different groups of students in architectural design courses has not been solved. In the early stage of the epidemic, online teaching is an excellent tool for home-based classes, but now it has entered the post-epidemic era. According to the current research trend, the mixed teaching mode of online plus offline has become a development trend because it can switch teaching status anytime. This puts forward higher requirements for teachers' teaching skills. We should explore how more traditional educational models can be integrated into mixed models. At the same time, in addition to theoretical courses and design courses, the online teaching mode of experimental and practical courses needs to be explored quickly so that a complete architecture comprehensive teaching curriculum system can be established.

## References

- [1] Pan Xinxin, Gong Yufa, Xiao Mufeng. Exploration of architecture curriculum system construction based on network teaching platform [J]. Journal of Liaoning Technical University (Social Science Edition), 2020, 22(6): 477-482.
- [2] Wang Zhen, Chen Zhiyu. Research on Online Education of Architecture Major in Epidemic Era —— Taking Central China as an Example [J]. China Architecture Education, 2020(02):129-134.
- [3] Wu Shanglin, Liu Dongmei, Ling Tao. The collision and interweaving of architecture Internet education and traditional architecture education [J]. Education Modernization, 2019,6(04):126-128.
- [4] Guanzhong Course. Micro-course [J]. China Information Technology Education. 2011(17):14
- [5] Niu Xiao, Yang Mengyang. Teaching Research of Digital Technology in Architecture under Online Micro-classroom Mode [C]// Information, Model and Creation —— Proceedings of the 2016 National Architecture Department Digital Technology Teaching Seminar., 2016:53-56.
- [6] Xiao Qing, Mou Xuejiao, Wu Yan. Research on Online and Offline Mixed Teaching Curriculum Construction of SPOC —— Taking Digital Technology of Architecture as an example [J]. Journal of changchun institute of technology (Social Science Edition), 2021,22(03):120-123.
- [7] Hou Shuai, Ren Zhonglong. Exploration of interactive mode of online teaching of architectural design course in post-epidemic era [J]. Chinese and foreign architecture, 2020(11):108-111.
- [8] Xue Yun, He Xiaoyan. Reconstruction and implementation of hybrid teaching mode of architectural design course based on network resource sharing cloud platform —— taking Inner Mongolia University of Science and Technology as an example [J]. Urban Architecture, 2019,16(30):57-59.