



# Research on Hybrid Teaching of Curriculums Based on the ADDIE Model

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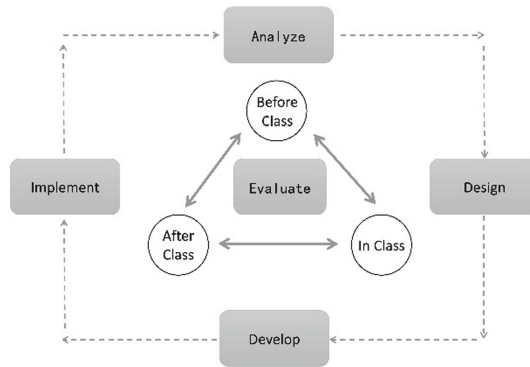
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**Abstract.** To introduce the hybrid teaching model based on the ADDIE model into the teaching of design visualization and explore its application effect, taking students of 2020 majoring in environmental design as the experimental group and students of 2019 as the control group, a two-year teaching practice research was carried out. A hybrid teaching method was implemented based on the ADDIE model for students of 2020. After teaching, the data analysis software was used to compare and analyze the final examination scores and course satisfaction of students enrolled in 2019 and 2020. Through the hybrid teaching reform based on the ADDIE model, we can clarify the learning purpose and cultivate design thinking and logic, expand learning forms, strengthen design practice ability, enhance teaching interaction, and stimulate the learning potential of teachers and students. The number of students with high scores increased, and the teaching effect was good. By and large, the hybrid teaching model based on the ADDIE model is conducive to the improvement of teaching methods and the enhancement of teaching effectiveness, and the course teaching is more standardized, structured, and systematic, which has reference significance for the reform and practice of relevant courses of design major.

**Keywords:** ADDIE model · Hybrid teaching · Reform in education · Design visualization

## 1 Introduction

The Opinions on the Pilot Program for Implementing the “Academic Certificate (1) + Vocational Certificates (X)” System in Colleges and Universities and the Instruction on Promoting the Piloting of the 1 + X certificate system (both hereinafter referred to as the Opinions) jointly published by the Ministry of Education, the National Development and Reform Commission and Ministry of Finance in 2020 claimed the 1 + X certificate system pilot as one of the training projects in colleges and universities since 2020. The implementing rules of the Opinions have laid stress on the establishment of proper mechanisms, scientific management systems, and effective evaluation approaches for the training and teaching practices of design students. While various teaching modes and evaluation methods for design have been developed in China, including CDIO, outcome-based education, project-based learning method, and hybrid teaching, the ADDIE model



**Fig. 1.** A Teaching Design Model based on ADDIE

is an unusual one. The ADDIE model is a teaching and training framework model designed and developed by the Education Research Center of Florida State University in 1975, which consists of five stages (i.e., Analyze, Design, Develop, Implement, and Evaluate). It is an integral, systematic, dynamic system with a defined process and thereby is capable of improving the productivity of courses of higher practicality [1]. Moreover, as a normalized teaching method, hybrid teaching is becoming an essential element of future teaching practice (Fig. 1).

In this case, taking the Design Visualization series as an example, this paper has introduced the ADDIE teaching model to launch practice research on the instructional design, teaching method, and teaching mode and have a comprehensive consideration (including evaluation, analysis, and summary) over the teaching effectiveness. It, in turn, aims to explore the theoretical and practical value of hybrid teaching based on the ADDIE model.

## 2 Problem Representation

The Design Visualization series (i.e., Design Visualization 1 and Design Visualization 2) is a compulsory course for environmental design students. As the prerequisite foundation course before core courses, it presents the knowledge of visualization representation for all drawings of design types and procedures, as a supporter and a developer of students' potential for the follow-up core courses.

In general, the Design Visualization series has the following features: (1) It's hard to establish a logical framework for the complicated knowledge and the software tool part requires higher practicalness; (2) The course emphasizes the development of design thinking and practical design of students, which, however, is difficult to cultivate and have a quantitative evaluation over; (3) The teaching contents are outdated due to both the rapidly-updated forefront concepts, visualization representation of drawings and applied technologies with respect to this major and few efforts are made to update the contents.

## **2.1 As New Technologies Emerge, the Teaching Contents Require Reconstruction**

As new information technologies and virtual reality software emerge, society and enterprises are presenting an increasing demand for talents in environmental spatial data analysis and design visualization. However, the existing teaching contents and methods are incompatible with the latest technologies and in need of reconstruction. Also, given the teaching objects are sophomores who just finished their basic courses for hand painting and are barely experienced in learning specialized courses like the practical computer-aided design, there is actually a gap between the students and the follow-up core courses.

## **2.2 Limited Classroom Patterns and Teaching Methods Impede the Improvement of the Students' Abilities**

As a theoretical and practical course, Design Visualization requires the students to deal with complicated design information/data in drawings, which indicates a higher demand for operative and applying abilities. But the mere teacher-centered approach and offline teaching cannot satisfy the students' current learning demands anymore and are unfavorable for diversifying the learning format and realizing knowledge internalization and ability enhancement. Therefore, it is urgent to introduce innovative classroom modes and teaching approaches.

## **2.3 Limited Classroom Time and Space Restrict the Interactions**

Traditional classroom teaching in China is mostly a form of one-way information dissemination, and the interactions between teachers and students and between students and students are insufficient. Besides, few platforms and tools are available for the students to contact their teachers or mates after class, by which they often have to understand and solve problems on their own. And from the teacher's perspective, the learning data and mastery of knowledge of the students are hard to track and collect, and thus an instant adjustment for the following teaching contents is almost impossible. Such a situation of limited time and space and insufficient communications is resulting in asymmetric information interchange between teachers and students, leading to misunderstanding and unfavorable teaching results.

# **3 Research Subjects and Methodology**

## **3.1 Research Subjects**

As for the environmental design major, Sanda University (Shanghai) recruited 61 and 60 students enrolled in 2019 and 2020 respectively. This paper considers students of 2020 as the treatment group and students of 2019 as the control group to carry out a two-year study of teaching practice.

## 3.2 Research Methodology

### 3.2.1 Preparation for Applying the ADDIE Model

The preparation involves establishing a teaching team for the ADDIE model, appointing the head of the Design Visualization course as the team leader, and gathering those who are experienced in instructional design and modeling & applying with a defined teaching age (>5 years) as the members. To provide a theoretical basis for the implementation of this study, it builds a conceptual framework for the hybrid teaching of Design Visualization based on the ADDIE model through literature review and deductive simulation, along with acquiring knowledge concerning the origin, current situation, application, and development of the ADDIE model via databases (e.g., Wanfang Data, CNKI, and CQVIP) on the computer.

### 3.2.2 Hybrid Teaching Practice of Design Visualization Based on the ADDIE Model

#### (1) *Analysis Stage*

The analysis stage is a precondition for designing the ADDIE model and, regarding the overall establishment of the hybrid teaching mode, it is crucial to analyze the learning state at the earlier stage. The analysis is conducted from four dimensions (i.e., learners' needs, teaching contents, requirements for learning capacity, and teaching environment) based on the ADDIE theory.

#### a. *Learners' Needs*

The analysis of learners' needs is the prerequisite of instructional design and an indispensable element of the process of instructional design [2]. This paper applies a questionnaire survey to collect the data, exploring design students' attitudes towards software learning, their anxiety for choosing a proper one among various software, the expectation of the difficulty of computer operation, etc. The study has collected a total of 114 valid questionnaires by WJX (wjx.cn) and concluded that: (1) 8.21% of the students have a higher enthusiasm for software learning, 78.36% have an average enthusiasm, and 12.69% are less motivated; (2) 72.93% feel very anxious about software learning, 23.30% barely feel anxious, and 3.75% have no sense of anxiety. In this case, the students feel anxious because the course involves a greater amount of mathematical knowledge, the demonstration of the course contents is obscure and it is hard for the students to understand and memorize the contents.

#### b. *Teaching Contents*

The existing textbooks for Design Visualization center on introducing basic software knowledge. In other words, they focus on theoretical knowledge but the demonstration of the practical operating parts is unfavorable. It is difficult to cultivate students who meet the requirements of enterprises if the teaching contents cannot realize an organic combination between theoretical knowledge and practical operation and remain incongruous with the students' specific learning state. Thus, reconstruction of the current course contents is necessary according to the students' learning characteristics, the school's

training equipment, and the teachers' knowledge and skills to make the contents harmonious with the project-teaching courses requiring a practical operation. Based on the stepwise design process from preliminary analysis to design deduction, and then to verification of results, it carries out a teaching case based on workflow redesign, upholding the educational philosophy of "learn in practice, practice in learning". In addition, in light of the particularity of hybrid teaching, the course may not set a normalized textbook but adopts handouts by instructors, MOOC videos, online course platforms/resource pools, and other creative teaching contents, achieving a multi-platform multi-elements hybrid system for teaching contents.

### c. *Requirements for Learning Capacity*

As a basic course designed for sophomores majoring in environmental design, the Design Visualization series aims to achieve the following goals for the students: (1) Knowledge exploration: the students are capable of understanding the theoretical knowledge concerning design visualization, including function analysis, mapping, data crawling, spatial structure, and function presentation, comprehending the correlation between design and other disciplines, and systematically mastering the design thinking and graphic expression in designing visual drawings; (2) Ability enhancement: the students are capable of conducting preliminary analysis, design deduction, result verification, and mapping for various projects, including interior design, architectural design, and landscape design, by the course's intention to activate the students' potential in independent exploration for new knowledge, creative thinking and solving practical design problems in and out of class; (3) Value guidance: the students are aware of the significance of the multi-disciplinary integration domestic and foreign knowledge to the subject development and the significance of spatial digital technology and Design Visualization to social development in the new era and are conscious of the importance of tracking and developing new theories and technologies in related disciplines, thus their motivation improves; (4) Personality development: the students shall be rigorous in research, form a conscientious and responsible craftsman spirit, improve their sense of responsibility and mission for modern China, aesthetic quality, and expertise, and hold a great ideal for promoting enterprise development and dedicating to national economic construction.

### d. *Teaching Environment*

Hybrid teaching differs from the traditional single teaching mode for it requires a more favorable classroom information environment, not limited to a space to teach and teaching aids [3]. At present, the teaching mode for Design Visualization focuses more on multimedia projection and computer demonstration; a hybrid classroom combining multimedia and computers may realize producing general interactive courseware, multi-screen interaction, software for demonstration, classroom assessment, PPT presentation assistance, and quick remark. Meanwhile, the establishment of an interactive teaching model in the existing Zhihuishu platform (zhihuishu.com) facilitates the practice of hybrid teaching. A hybrid teaching environment aims to integrate the advantages of the online classroom in intelligence, big data, and the internet, and of the traditional offline classroom, which is not simply an overlap of the two teaching modes but an introductory intelligent teaching process rather considering students as the body and teachers as the

head. Above, for both highly theoretical and practical courses, it is of great significance to build a hybrid teaching mode, adjust properly the proportion of online and offline teaching, reconstruct the teaching contents, and apply diversified teaching approaches.

### (2) *Design Stage*

Based on the conclusion drawn in the analysis stage, it analyzes the current problems and suggests a design concept for hybrid teaching. A reconstruction of the teaching contents is planned on the premise of ensuring the continuity of the early basic courses and optimizing their connection with the follow-up core courses in 3 modules: (1) preliminary analysis: interpreting the impact of environment, function, and audience on the design plan; (2) design deduction: presenting the design concept and logical thinking; (3) result verification: verifying the rationality of the design. Considering the requirements of hybrid teaching, the modules are further divided into 12 sub-modules (4 for online learning sub-modules). Specifically, there are 24 online classes out of the total 64 classes, accounting for 37.5%.

Problem 1: It attempts to add more cutting-edge advanced teaching contents (e.g., data crawling, visualization representation, and presentation of simulation effect) while reserving the traditional drawing expression. Also, the society's requirements for big data talents, the characteristics of the environmental design major itself, the update of the teaching contents, and the proper guidance of the students' interest in learning are critical elements.

Problem 2: It attempts to add more teaching content for independent thinking and practicing, including landscape/architectural typology analysis and function analysis, to improve the students' ability to analyze and solve problems. Again, the design of the teaching contents shall follow the "preliminary analysis + design deduction + result verification" process, emphasizing the training of logical thinking.

Problem 3: It attempts to set teaching content modules that require teamwork or student-teacher communication to improve the interactions between teachers and students and between students and students. The students are involved in the virtual space presentation and drawing expression parts of the overall planning and management of an actual project in groups. During the process, students with different characteristics transfer from separate design performers to planners and creators that can exploit their advantages and collaborate. It, in turn, stimulates their learning interest and motivation and cultivates their communication skills and teamwork spirit.

Based on the specific features of Design Visualization, a hybrid teaching content system for cultivating talents who are acquainted with environmental spatial data, geographic spatial analysis, and visualization of design drawings, as shown in Fig. 2.

### (3) *Development Stage*

Based on the design stage, the development stage focuses on developing resources to support hybrid teaching [4]. It adopts the Zhihuishu platform as the teaching tool and selects the MOOC courses with complete content and test questions as the teaching contents for the online flipped classroom. In the process of hybrid teaching, emphasis should be put on the "topic + project" teaching approach and process demonstration and displaying massive actual cases (finished in the past 5 years), pictures about student

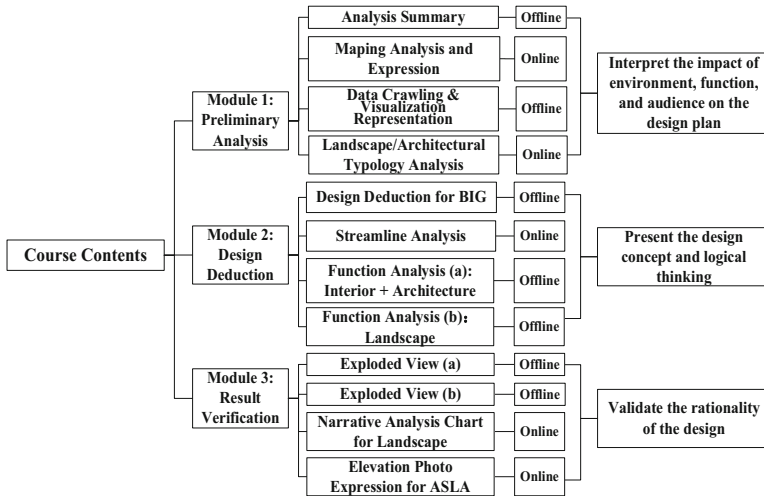


Fig. 2. Framework of the teaching content system

practice, and excellent student works. Excellent student work should include the final design effect presentation, training records, project case package, etc. It is important to build and maintain an online library for teaching materials and cases, a database for prize-winning works, a guidance document for teaching, and an online test and evaluation system.

In addition, the design cases and practical projects shall be updated according to the changing design trend and hot issues in the industry. For instance, in the 2020 academic year, the teachers presented pictures and videos through Zhihuishu to help the students understand the post-outbreak industry changes, highlighting innovative and pioneering knowledge. By issuing a design project concerning the village activity center from the “beautiful countryside” idea, the teachers guided the students to ponder the responsibility and mission of the industry they involve in society.

(4) Implementation Stage

This stage focuses on ensuring the effective implementation of the course contents and teaching methods built in the early stage and evaluating the learners’ responses immediately. In light of the characteristics of hybrid teaching, it aims to construct a hybrid teaching system based on the ADDIE model by upholding the teaching idea of “regard student as the center, regard students’ ability development as the goal”, making full use of the online and offline high-quality teaching resources for national-class courses, practicing hybrid teaching activities before class, during class, and after class, and building a course content mechanism that consists of basic knowledge, innovation design, and general practice (Table 1).

According to the OBE concept, the course objectives and students’ graduation requirements are used for formulating the methods and contents of course evaluation as a supporting evaluation mechanism for the hybrid teaching approach, realizing a scientific

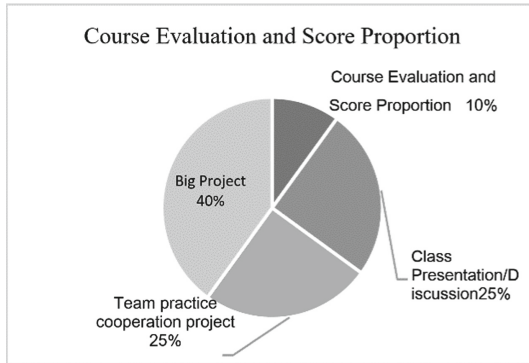
**Table 1.** Design and Implementation of Hybrid Teaching

<b>Design and Implementation of Hybrid Teaching</b>			
Teaching Sessions	Teach Activities	Student Activities	Highlights
Before Class	a. Post online learning tasks. b. Have immediate communications c. Be aware of students' learning state, and plan offline teaching content and schedule.	a. Learn MOOC, teaching videos, tutorials, etc., finish pre-class tests; b. Conduct discussions between teachers and students and between students	a. Easy to collect study data for teachers to plan offline teaching affairs; b. Learn the relevant theoretical knowledge in advance, more time for offline discussion and practice.
During Class	a. Explain common problems; b. Organize discussion and work presentation, and conduct peer assessments between teachers and students and between students	a. Carry out project practice in teams; b. Report, discuss and interact with teachers and mates.	Conducive to consolidate the understanding of knowledge, and improve the skill of teamwork, exploration, and problem-solving.
After Class	a. Online communications, answer questions and rethink; b. Post after-class rethinking work and assignments through Zhihuishu; c. Make a summary and adjust the next teaching activity.	a. Rethink in-class assignments; b. Submit assignments on the online display platform.	a. Convenient for teachers to judge and analyze students' learning state, eliminate the possibility of "muddling through"; b. Be able to verify whether students have achieved their learning objectives, and provide a reference for the teaching schedule.

system for assessing academic performance. The overall results are structured, as shown in Fig. 3.

- a. Class presentation or discussion accounts for 10%, including online platform sign-in, offline attendance, and the times and quality of class presentations and discussions;
- b. Stage daily assignment accounts for 25%, including the frequency of posting, the progress of online courses, the completion degree and correctness of online tests to reflect the mastery of knowledge, and the quality of offline daily assignments;
- c. Teamwork practice project accounts for 25%, including the quality and effect of PPT presentations, the quality of team works, and the PBL results to reflect the students' critical thinking;





**Fig. 3.** Course Evaluation and Score Proportion

- d. Course project (students submit design works, and the teachers, along with enterprise tutors, leave comments on the drawings with a score) accounts for 40%, which focuses on the depth perception and transfer ability of the students for the knowledge and aims to evaluate the students' ability to analyze and solve problems and of creative thinking.

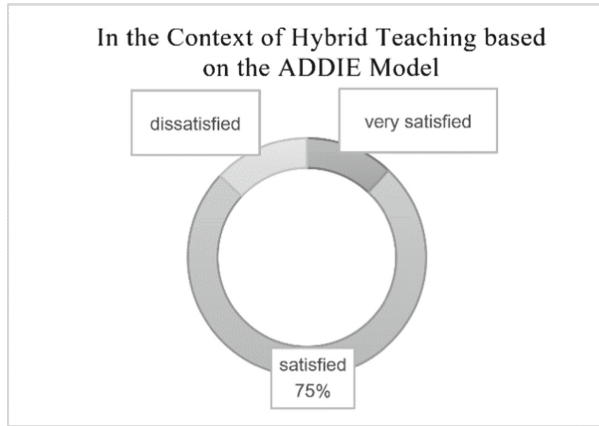
## 4 Result Feedback

### 4.1 Data Analysis of Teaching Effectiveness

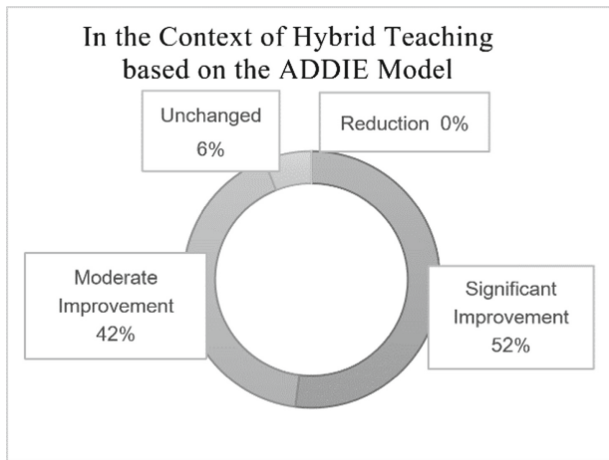
According to the feedback (an anonymous questionnaire by WJX) from students of 2020 (60 people) that received the hybrid teaching model based on the ADDIE model, the model has achieved favorable teaching effects. 77% of the students are very satisfied or satisfied with the teaching reform. 52% believe that the hybrid teaching model based on the ADDIE model has significantly improved their interest in learning, changed their cognitive model and study habits, and effectively enhanced their subjective initiative. 95% recognize that hybrid teaching has stronger interactivity than the offline classroom, which encourages students to question and express their opinions and contributes to the deep mastery of knowledge, as shown in Figs. 4, 5, and 6. From another perspective, the peer teachers and supervisors claimed that the new teaching approach has a reasonable teaching mechanism and is highly beneficial for ability enhancement and that the improvement of interactivity significantly facilitates the virtuous development of education.

### 4.2 Comparative Analysis of Final Examination Results

Using SPSS, the study had a box-plot analysis of the final examination results of the control group (2 classes of 2019) and the treatment group (2 classes of 2020), and it shows that the two classes of 2020 have higher average scores (above 80) the two classes of 2019. Compared with the control group, the treatment group has more students with a



**Fig. 4.** Overall Evaluation of Students



**Fig. 5.** Evaluation of the Influence of Hybrid Teaching on Learning Interest

high score (specifically, the number of students with a score above 90 is significantly greater than that of the control group), fewer students with a low score, and no students with a score below 65. In general, by the implementation of hybrid teaching based on the ADDIE model, students of 2020 have a considerably-increased total score, and their mastery and internalization of knowledge are better than students of 2019, as shown in Fig. 7.

Nonetheless, as a disadvantage of the analysis, the scientificity of the results is facing a crossover impact by sample size and other factors. Due to the limited sample size and research time, the study had no opportunity to have a general investigation of the influence of the ADDIE model and hybrid teaching on the examination results in detail. Moreover, it is recommended to cover other considerations such as teacher guidance and learner’s individual differences to conduct in-depth research on the causality and

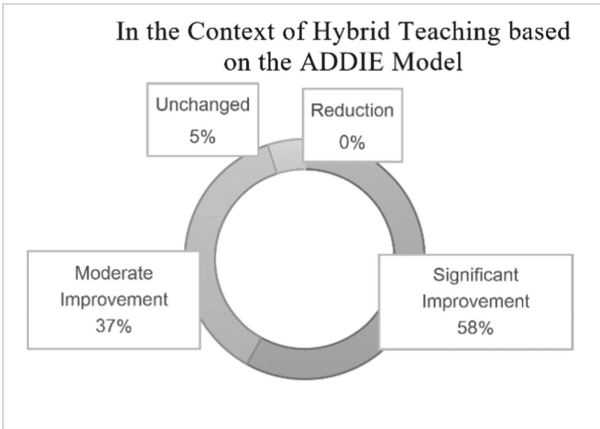


Fig. 6. Evaluation of Classroom Interaction

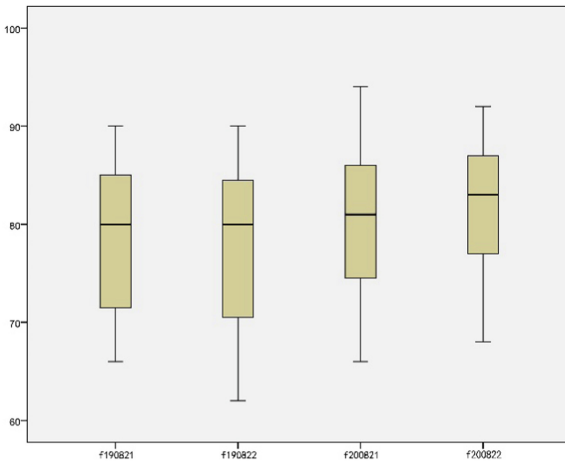


Fig. 7. Comparative Analysis of Final Examination Results

impact strength of the hybrid teaching model based on the ADDIE model on student performance, thereby proving the scientificity of hybrid teaching further.

## 5 Conclusions

The applied research of hybrid teaching based on the ADDIE model has realized a relatively complete frame system for Design Visualization, which diversifies the learning format, improves the reconstruction of the teaching contents, and is optimizing the teaching approaches and examination modes. Compared with the traditional teaching model, hybrid teaching based on the ADDIE model emphasizes the subject position of students and enhances the interaction between teachers and students, representing a favorable teaching performance.

## 6 Discussion

However, it remains some problems during the teaching research worth discussing and rethinking: (1) The teachers have to spend more time and energy on preliminary modeling and teaching process designing. In other words, a research plan is a prerequisite, yet there is still a possibility that many unforeseen situations would emerge during the implementation to bias the research results, thereby increasing the workload objectively and suggesting a more rigorous requirement for the teachers' personal professionalism; (2) The students may have not been exposed to and are unaccustomed to hybrid teaching, where the teachers shall have a continuous observation on whether the students can be accustomed; (3) Peer assessment may be a favorable strategy for formative evaluation given the limited energy of the teachers [5]. However, the technique to improve the learning outcomes by mutual rating or feedback among learners, the coordination between peer assessment and teacher assessment in several rounds of evaluation, and the determination of the proportions of peer and teacher assessments for the final result remain unresolved. In this case, how teacher assessment fixes the confidence of the learners in peer assessment requires further study [6].

Above, impacted by such a teaching model, the students have stronger selectivity and participation and their learning mode is transferring from passive learning to active learning, which contributes to their coordination between implicit and explicit knowledge. Still, given the complexity of teaching activities and the uncertainty of evaluation results, hybrid teaching based on the ADDIE model needs further practice and research.

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