

## Application of Information-based Teaching Means in the Architectural Engineering Survey Training Course

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**Abstract:** In the traditional teaching method of architectural engineering survey practice, the teaching mode of “teacher lecture-teacher demonstration-student drill, and teacher guidance-teacher review” is implemented. The whole process still regards the teacher as the focus, and rely them heavily on imparting knowledge. With the introduction of digital teaching platform, simulation software, WeChat, virtual reality technology, blue ink cloud class and other information-based teaching methods, students are not limited by time and space. In addition, the content is more understandable, and the skill operation is more intuitive and clear. So the new teaching mode has improved students' interest and efficiency, increased the enthusiasm of teachers, and also led the whole class to be interactive.

### 1. Introduction

In tradition, the architectural engineering survey training course is often led by teachers, when students focus on listening. So there is less information, fewer positive students, and of course, less active class. Nowadays, information-based teaching means, such as digital teaching platform, simulation software, WeChat, and blue ink cloud class, give students chances to gain the knowledge independently. They are able to preview before class, practice in class, review and discuss after class. With the help of animation, video, simulation software, VR technology, etc., the visualized confusing points turn to be more simple, interesting and understandable. So the new course mode, ‘student-centered, teacher-led’ has been realized, and the teaching philosophy of “doing while learning, learning while doing” has been practiced[1][2].

### 2. Instructional Design of Architectural Engineering Survey Training Course

#### 2.1. Analysis on the Study State

Most students majoring in architecture in higher vocational colleges are weak in theoretical foundations, and always not interested in the study of theoretical knowledge. However, they are good at image thinking and practical operation. They have the ability to use digital resources for independent learning, when they have the knowledge of critical operation. Therefore, we can apply a variety of information-based teaching methods to classroom teaching, and design the teaching process according to the philosophy of “doing while learning, learning while doing”[3][4].

## 2.2. Teaching Contents

Based on the teaching background, the actual engineering project, and the engineering construction process (which includes survey design, construction, and operation management), we integrated the measurement knowledge and skills required for the construction workers and technicians into six items, including 25 tasks in total. The teaching content has been reorganized, to form a structured curriculum system, in which necessary knowledge points and skill points have been involved as shown in Table 1.

Table 1 the list of knowledge points and skill points

1	instruments and tools for leveling	7	internal calculation of coincidental leveling line	13	operation steps of total station
2	DS3 level	8	instruments and tools for angle measurement	14	GPS-RTK
3	operation steps of DS3 level	9	operation steps of theodolite	15	RTK operation
4	auto-set level	10	horizontal angle measurement in two directions	16	mapping with Cass
5	field data record and check in leveling line survey	11	measuring- distance instruments and tools	17	building setting-out
6	internal calculation of closed leveling line	12	total station	...	.....

## 2.3. Teaching Objectives

According to the requirements of job markets, teaching objectives of the course content are determined as: have the knowledge of the measurement work principle, and the construction measurement specifications, master (1) elevation, horizontal angle, distance measurement methods, (2) elevation, angle, distance measurement method, (3) building setting-out method, (4) building settlement, tilt observation method, (5) building hoisting measurement method, and the completion measurement method.

Except for the knowledge target, capability target is also of great significance. Students should master the practical operation skills, and can carry out basic surveying, setting-out work independently. According to design drawings, they can make the building be leveled, settled and tilted. Both hoisting measurement and completion measurement should be handled.

Last but not least, quality objectives are essential: self-learning skills, responsibilities for work, independence on tasks, analytical capabilities, innovation and sum-up experience, etc. what's more, students must have and abide by the professional ethics, the spirit of cooperation and the ability of management coordination.

## 2.4. Key Points in Teaching

Aimed at the teaching objectives, the key points of this course are: to operate the practical instruments, to carry out setting-out, deformation observation, hoisting measurement of the building. The teaching difficulties may exist in the design and implement of setting-out, flattening, hoisting measurement, deformation observation and implementation of the building.

## 3. Application of Information-based Teaching Methods in Practical Teaching

The construction engineering measurement training course is based on the teaching philosophy of "doing while learning, learning while doing". Before the class, the teaching tasks are released through the digital teaching platform, QQ, WeChat group, etc., and the digital teaching resources are uploaded, which are well prepared for students to learn independently. Relying on the informational carriers, such as blue ink cloud class, virtual reality technology, total-station simulation teaching software, etc., theoretical knowledge and practical skills teaching can be completed through the resources in sharing classes like micro-courses, video, animation and so on.

Then students do the practice before teachers evaluating, which definitely aimed at “doing while learning, learning while doing”. The digital teaching methods help students to understand the class content and to break through the difficulties. After the class, students can also use the course teaching platform, and the blue ink cloud class to achieve online Q&A, teacher-student interactions, key points review, which would enhance their knowledge foundation, and benefit them a lot.

In the following part, the case of "horizontal angle measurement in two directions" will be taken as an example to introduce the application of informational teaching methods in the engineering survey training course. According to the cognitive rules and learning characteristics of students, the teaching process is divided into self-learning before class, practice in class, and complement after class. To be more precise, students need to go through the course by previewing the content, creating a situation, focusing on tasks, practical training, receiving the evaluation, and discussion after class. The implementation process is shown in Figure 1.

Details of the implementation process can be illustrated as following:

**Before class:** Teachers use cloud class, WeChat group, QQ group to release the learning topics to students, and upload relating resources for quality courses to the digital course platform. Students can have a look on learning tasks from the online classroom, online library, or dormitory registration platform, and they are authorized to download these learning materials for self-learning. To complete the pre-class preparation, students can ask questions and even upload them to the course platform, in which teachers can summarize and answer the questions raised by the students, evaluate the students' pre-study, and do more interactions with the students.

**In class:** integrated classroom teaching mode. Students can log in the platform 5 minutes before the class. In order to fully achieve students' primary status, the 2 hours of course teaching is set to be four sessions.

#### Session 1: Creating a situation

The teacher uses the digital course platform to review the pre-study, create a learning situation based on the common problems raised by the students, and publish the work tasks: use the angle measuring instrument (total station) to carry the horizontal angle between the two adjacent axes of the building. For measurement, fill in the “Return Method Observation Angle Record Handbook” and perform accuracy assessment.

#### Session 2: Focusing on tasks

##### (1) Pointing instrument operation points

The horizontal angle measurement of the rounding method focuses on the operation of the angle measuring instrument. In order to enable the students to better grasp the operating points of the angle measuring instrument, the digital course teaching platform is combined with the teaching videos to visualize the abstract problems.

##### (2) Horizontal angle observation of the rounding method and accuracy assessment

Teachers can use our self-developed total-station simulation teaching software, and explain the knowledge points in detail through the micro-course, video, and course teaching platform. The total station simulation teaching software can make operation interface in the horizontal angle measurement process of the round return method clear at a glance, while the course teaching platform can provide a wealth of teaching video and fragmented resources, which allow students to replay multiple times if they cannot follow the course. So the difficult points in the class content can be simplified, and students' training course can obtain better effects.

##### (3) Develop a implementation plan

when the tasks are clarified, the teams can complete the implementation plans and uploaded them to the course platform. The teachers organized the teams to report the group plan in turn, and summarized the implementation points of the tasks, emphasized the safety operation rules, refined the operation steps, and evaluated the student programs.

#### Session 3: Practical training

Each team should operate on site following the requirements, and then take the completed task order into photos, take the horizontal angle measurement process into a video, after which upload

them to the cloud class. Both the teacher and students can have a view of the training work of other groups, and find the problems, give suggestions and evaluations. This kind of real-time process assessment can increase the value of charm, and help to achieve the objectives of teaching.

#### Session 4: Receiving the evaluation

The teacher timely scores the students' knowledge preparation, operation skills, classroom performance, etc., and gives the results into the course platform to achieve the process evaluation. Finally, the teacher summarizes the training tasks and arranges the next class learning tasks.

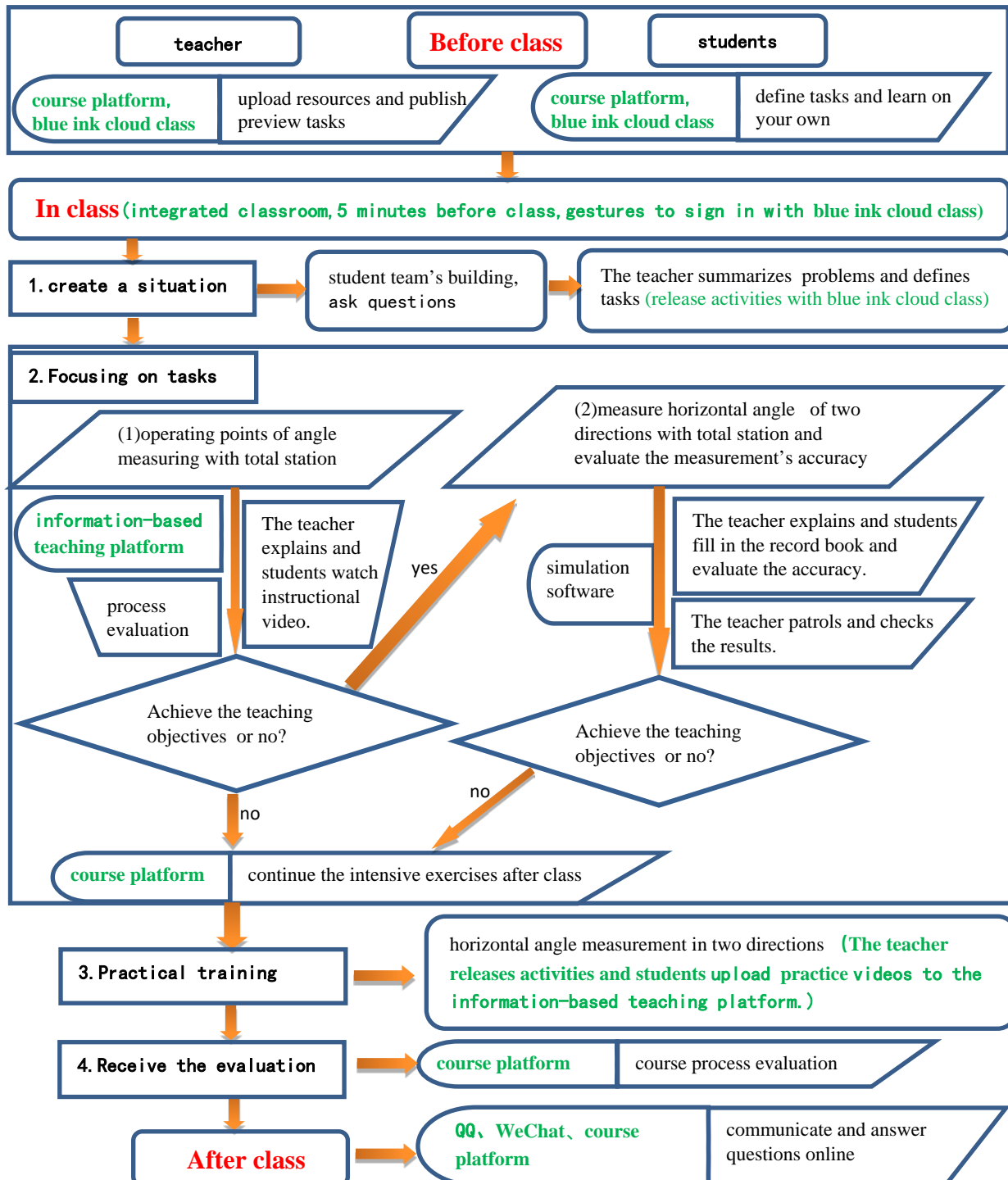


Figure 1. implementation process of architectural engineering survey training

#### 4. Teaching Results

The application of information technology has improved the teaching effect of construction engineering measurement training course. Through the process assessment, questionnaires and other methods to analyze the learning situation of students during the past three years, as shown in Figure 2, it is found that the indicators in the teaching using information-based methods have greatly improved, compared with that in traditional teaching mode. And also, the employment rate of students has increased, as they already have the ability to win many awards in provincial and municipal skill competitions.

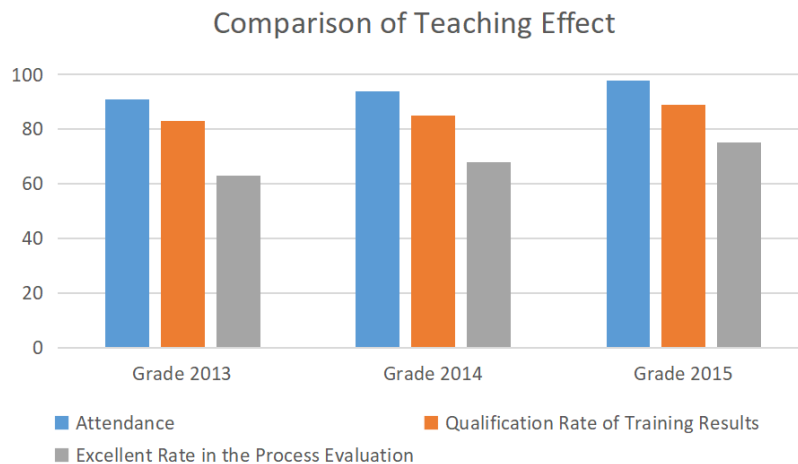


Figure 2. comparison of teaching effect

#### 5. Conclusion and discussion

The application of information-based teaching methods, such as course teaching platform, and cloud class, in construction engineering measurement training course, contributed a lot to teachers' teaching, improved students' enthusiasm and initiative, and what's the most important, enhanced the teaching effect. However, this teaching mode puts forward higher requirements for teachers to prepare the lessons, which means teachers need to spend more time and energy to design, prepare and upload course resources. In addition, informatization teaching still needs to be constantly improved, and it cannot be used as it is informatization. Only by combining the characteristics of the curriculum with the scientific use of information-based teaching methods, can the course teaching be even efficient and effective [5].

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