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An Exploration of the Application of Case Study Teaching of Flatwork Literacy in Professional Practice

Peipei Zhao[1,2,3], Zhenyu Wang[1,2,3,✉]

[1] *School of Civil Engineering, Institute of Disaster Prevention, Sanhe, Hebei, 065201, China*
[2] *Key Laboratory of Building Collapse Mechanism and Disaster Prevention, China Earthquake Administration, Sanhe, Hebei, 065201, China*
[3] *Hebei Technology Innovation Center for Multi-Hazard Resilience and Emergency Handling of Engineering Structures, Sanhe, Hebei, 065201, China*

ABSTRACT

In order to meet the needs of high-quality development of the civil engineering industry, it is necessary to carry out corresponding teaching reforms in the level drawing course as a core basic course. The purpose of this paper is to explore whether the case teaching of leveling drawing can effectively improve students' ability of leveling drawing. By analyzing the level drawing course, the case teaching method of level drawing is designed. Students of a higher vocational school were selected as the experimental objects, and the questionnaire survey was used to understand the current learning status of the students' drafting and to carry out the teaching practice, and the statistical analysis method was used to explore the teaching effectiveness. After the teaching practice, the students' learning attitude, skill mastery and teaching satisfaction increased by 46.24% as a whole, which was significantly different from the learning status quo before the practice ($p < 0.01$). Meanwhile, there was an improvement of 8.52% and 5.57% in learning achievement over the pre-practice and comparison students, respectively. The results indicate that case teaching of leveled drafting can effectively improve students' learning attitudes, develop students' skill mastery, enhance teaching satisfaction, and it has a significant role in promoting students' learning outcomes in leveled drafting. This study confirms the value of case teaching of plain drawing in professional practice and has positive significance for improving the quality of education.

Keywords: level drawing, questionnaire survey, statistical analysis, teaching practice, teaching effectiveness

✉ Corresponding author.
E-mail address: wangzhenyu@cidp.edu.cn (Z. Wang).
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1. Introduction

At present, China's economy has shifted from the stage of high-speed growth to the stage of high-quality development, and in the face of the accelerated industrial upgrading process, the construction industry has put forward higher requirements for the innovation quality and application ability of practitioners. The civil engineering majors of local general undergraduate colleges and universities should fully integrate the direction of applied talent cultivation, closely combine with the local economic development and social needs, actively promote the reform of talent cultivation mode, and effectively deliver applied professional and technical talents with higher academic level, stronger practical ability, and outstanding comprehensive quality to the industry [1-3].

Pingfa literacy drawings refers to the overall presentation of the plane of concrete construction drawings drawing rules as well as the composition of sample drawings [4-5]. It is the main basis for civil engineering designers to implement the design at the present stage in China, and it is also the basis for budgeting, supervision and other units to accurately grasp and implement the level drawing [6-7]. However, in the course of explaining the knowledge of leveling drawings, the traditional teaching method will be abstract and boring, especially on the wall structure construction drawings, which involves complex and diverse structures, and it is difficult to stimulate the interest of students [8-11]. And the use of case study teaching method, case-oriented teaching, can really improve the quality and effect of teaching [12-13]. The combination of leveling method and case study teaching method can make students fully understand the plane presentation form of concrete construction drawings, and ensure the accurate and no difference mastery of construction drawings based on the beams, slabs, columns and other essentials in the construction of concrete drawings [14-18].

The article analyzes the current situation of case teaching of plain drawing and its application in professional practice, and puts forward the ideas of case teaching of plain drawing from the dimensions of carrying out diversified teaching, optimizing the teaching process and stimulating students' interests. Based on this, taking the architectural engineering students of a higher education institution in X city as an example, two classes with comparable level of level drawing literacy were selected to implement the teaching experiment. Before the action research, the current learning status of the students was understood from three levels: learning attitude, skill mastery and teaching satisfaction. At the end of the action research, students in the two classes were assessed on the test of plain drawing, and the survey data were analyzed by combining the test scores of the two classes and the questionnaires on the learning experience of the experimental class to test whether the use of plain drawing case study teaching has a facilitating effect on the enhancement of the students' learning of plain drawing.

2. Leveled Drawing Course and Case Study Teaching Methods

Flat law drafting is a professional foundation course for higher vocational architectural engineering technology majors and a professional skills course, which is characterized by theory, comprehensiveness and strong practice. The effective use of case study teaching of leveled drawing in professional practice is discussed.

2.1. Plain Drawing Course

Concrete structure construction plan plan overall representation (referred to as flat method) is the size of structural components, location and reinforcement and other information, in accordance with the rules of flat method of drawing, the overall direct expression of the structural layout plan, and then with the standard construction detailing, constituting a complete set of structural construction

drawings method. The current standard atlas of level drawing is 16G101 series atlas, which is generally divided into two parts: level drawing rules and construction details.

Drawing is a professional foundation course for higher vocational architectural engineering technology majors, but also a professional skills course, with theoretical, comprehensive and practical characteristics. Students need to recognize the common types and characteristics of building structures through the study of this course, be familiar with the drawing rules of the overall representation of concrete structure construction drawings, the basic ideas and methods of structural component reinforcement design, and be able to analyze the structural details of reinforcement structure, focusing on mastering the formation of structural construction drawings, the content of the drawings and the reading method.

2.2. Teaching methods for case studies in plain drawing literacy

The main content of the case study teaching method of plain drawing is shown in Figure 1, the course should create a new teaching mode, practice the concept of "Internet + education", fully mobilize the autonomy and enthusiasm of students' learning, improve the learning efficiency, improve the core competence of reading structural construction drawings, and lay the foundation for students to embark on the workplace.

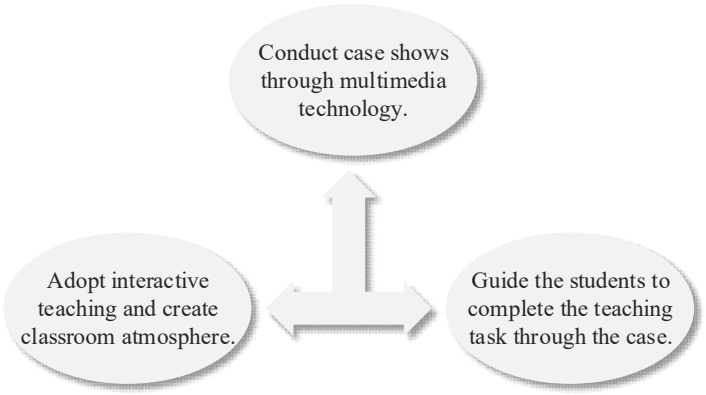

Fig. 1. The main content of the flat reading method case teaching

2.2.1. Diversifying teaching and learning. Drawing is the key content of the teaching of reading and reading drawings for civil engineering majors in Chinese universities and colleges. As the key professional content of civil engineering, the traditional teaching forms and means are monotonous and uninteresting, but with the innovation of science and technology and social progress, multimedia technology and models and other modern teaching equipment are widely used, teachers should maximize the use of different teaching methods to organize teaching activities.

The combination of multimedia teaching and on-site practice visits is adopted. The course of building structure foundation and leveling drawing is usually offered in the first academic year, and most students have no experience of entering the construction site. Considering this factor, the course teaching process should first lead students to visit the construction site of reinforced concrete structure, so that students have perceptual understanding. During the teaching process, as many pictures and videos of the construction site as possible should be selected to deepen students' understanding. In addition, in the selection of teaching materials, three-dimensional leveling drawing tutorials are used to help students establish a sense of space and three-dimensional sense.

2.2.2. Optimizing the teaching and learning process. The teaching process combines case guidance to help students gradually achieve the learning objectives. Taking the reinforced concrete column leveling method as an example, the teaching can be carried out sequentially according to the

following process: (1) New lesson introduction. The teacher demonstrates the reinforced concrete column in the field through video, pictures, etc. after the reinforcement is tied and the mold is removed, and then gives the corresponding structural construction drawings to guide students to think and recognize the components. (2) Give the general task. Assign students to sample the reinforcement of reinforced concrete columns on a particular floor, and you can group the class into groups, with each group completing the sampling of reinforcement on a different floor. (3) Break down the task and explain the system. The workload and difficulty of the total task are large, and students cannot sort out the clues and ideas, so they need to decompose the total task into secondary tasks such as "understanding the reinforcement in the reinforced concrete column, learning the flat rules of the reinforced concrete column and drawing the column cross-sectional diagram, learning the standard structural details of the reinforced concrete column and drawing the column longitudinal profile, and drawing the reinforcement separation diagram". According to the decomposed level 2 tasks, step by step, students develop their problem-solving skills. (4) Case practice. After the above steps, students have a preliminary grasp of reinforced concrete column leveling method, at this time should be strengthened with case practice. (5) Post-course expansion and evaluation. Students use the course resource library and the public platform of WeChat to review after class and deepen their understanding through repeated comparisons of two-dimensional drawings and three-dimensional models in the library. After learning, an online test is conducted to test the learning effect, and teachers should reflect and summarize in time according to the students' test results.

2.2.3. Stimulating student interest. Stimulating students' interest can be started from the following aspects: (1) Teachers should adopt interactive teaching to guide students to solve problems together step by step, so that students can realize their main position in the learning process and change passive learning into active learning. (2) Give students affirmation and encouragement in time. When students complete a homework, answer a question, the teacher should give students timely affirmation, increase the motivation of students to take the initiative to learn. (3) Provide students with opportunities to show themselves. Teaching should pay attention to provide students with the opportunity to show themselves, such as after the column method, let the students work in groups to tie the steel skeleton model, and then ask the students to show the group, the group mutual evaluation and then the teacher's comments, in order to satisfy the students' desire to perform, enhance the students' self-confidence, and cultivate the students' sense of teamwork.

3. Action research design

In this study, the case teaching method is used to develop teaching practice in the teaching course of level law literacy drawing in higher vocational schools. In order to improve the problems and deficiencies in the teaching of the traditional flat law literacy course, and to verify the effectiveness of the case teaching of flat law literacy at the end of the action research.

3.1. Subjects of study

The school selected for this study is a higher vocational school located in X city, which, as a national key vocational school of construction directly under the provincial education department, specializes in the cultivation of technical talents in the construction industry. In order to ensure that the experimental group and the control group students have roughly the same learning foundation before starting teaching, so as to ensure the accuracy and fairness of the later performance analysis, the learning ability of students in several classes in the first year of the building engineering construction program was first assessed. The purpose of the assessment was to verify that the two groups of students had the same level of learning. It was found that the students in the first and second classes of the Building Engineering Construction program were basically the same in terms of

their performance in leveled drafting, so these two classes were selected for the study. In the study, the first class of Building Engineering Construction (51 students) as the experimental group was taught using the case method, while the second class of Building Engineering Construction (49 students) as the control group was maintained in the traditional mode of instruction.

3.2. Action Research Preparation

In order to grasp the current status of the teaching of leveled drafting in the target schools and the development of students' competence in the course, it is necessary to have a preliminary understanding of the basic learning situation of the study participants.

3.2.1. Questionnaire design. The questionnaire was designed according to the talent cultivation objectives of secondary school building engineering construction majors, and the questionnaire topics took into account the three aspects of students' learning attitudes, skill mastery and teaching satisfaction, and the questionnaire was divided into two surveys in the pre-survey and post-survey. A five-point Richter scale was used to rate the applicability of each description, with each question corresponding to “A not at all = 1, B not quite = 2, C generally = 3, D quite = 4, E completely = 5”. The pre-action questionnaire, “Questionnaire on the current status of middle school students' learning of plain drawing”, was distributed to the students of two classes, and a total of 100 valid questionnaires were distributed and recovered.

3.2.2. Current state of learning in plain drawing literacy:

1) Learning attitude to be improved. The statistical results of the learning attitude questionnaire are shown in Figure 2, including learning interest, course attitude and course understanding. From the dimension of learning interest, the proportion of options choosing not at all and not very much is as high as 53.8%, while the option of thinking that it is fully compatible only accounts for 6.10%, which indicates that at present most of the students think that the course of leveling and graphing is relatively boring, and they can't bring up the interest in learning, and it is difficult for them to learn.

From the dimension of course attitude, the proportion of “not quite” is the highest, 29.1%, and the option of “fully” only accounts for 6.9%, students' learning initiative is relatively poor, and their learning attitude needs to be changed.

From the dimension of personal cognition, the proportion of “not quite” option is the highest, 30.6%, and the proportion of “fully” option is only 9.9%, which is the smallest, most of the students don't have a deep understanding of the course of leveled drawing and can't master and apply the theoretical knowledge. Most of the students do not know much about the level drawing course and cannot grasp and apply the theoretical knowledge well.

In summary, most students also showed relatively low interest in learning knowledge in the leveled drawing course, and the causes of this phenomenon were mainly related to the classroom atmosphere, teaching methods, and the attractiveness of the material content. As the core of the teaching process, students' interest level significantly affects their participation in the course. In terms of course attitude, students lack self-driven learning motivation and problem-solving initiative. Therefore, improving the attractiveness of the classroom and stimulating students' enthusiasm and initiative for learning are crucial for improving the teaching effectiveness of the leveled drawing course.

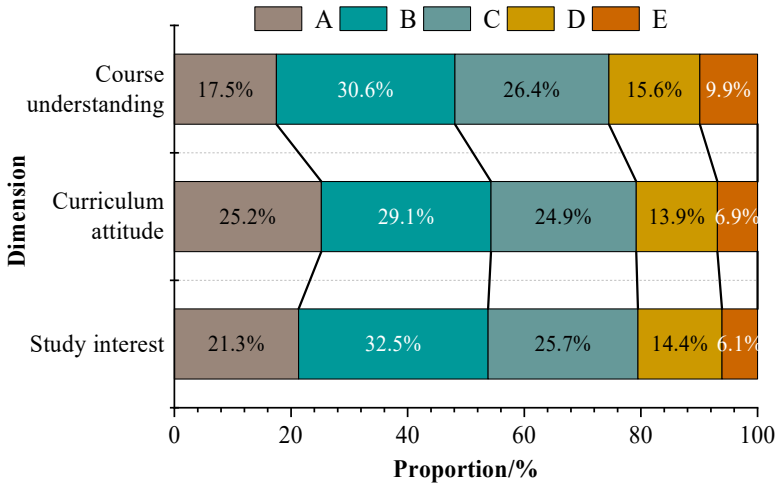

Fig. 2. Study attitude questionnaire statistics

2) Skill mastery needs to be strengthened. The degree of skill mastery in the questionnaire survey includes a total of four aspects: reading drawings, calculating quantities, placing materials and tying. The results of the skill mastery survey are shown in Figure 3. Most of the students for the four dimensions of the leveling skills mastery is concentrated in the “not quite meet” and “generally meet”, accounting for more than 58%, less than 11% of the students chose the “fully meet Less than 11% of the students chose the option of “fully compliant”, indicating that most of the students have not mastered the relevant methods and skills of plain drawing, and they have difficulties in practical application, and they cannot process and analyze the data well.

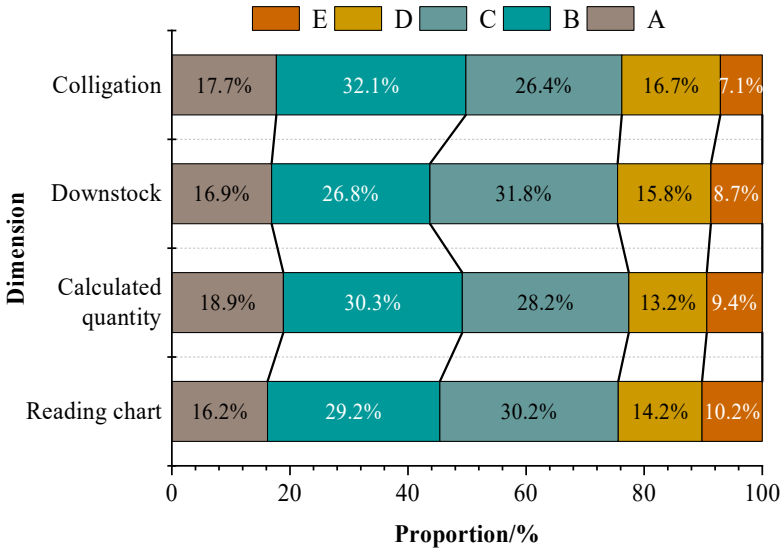

Fig. 3. The results of the degree of skill mastery

3) General Teaching Satisfaction. The teaching satisfaction dimension of this questionnaire is divided into five parts: course innovation, practicality, inspiration, appropriateness, and classroom atmosphere. The survey of teaching satisfaction is shown in Figure 4. More than 51% of the students chose the options of “generally meet” or “not quite meet”, indicating that the students' satisfaction with the teaching of the course is at an average level. This indicates that students' satisfaction with the teaching of the course is at an average level.

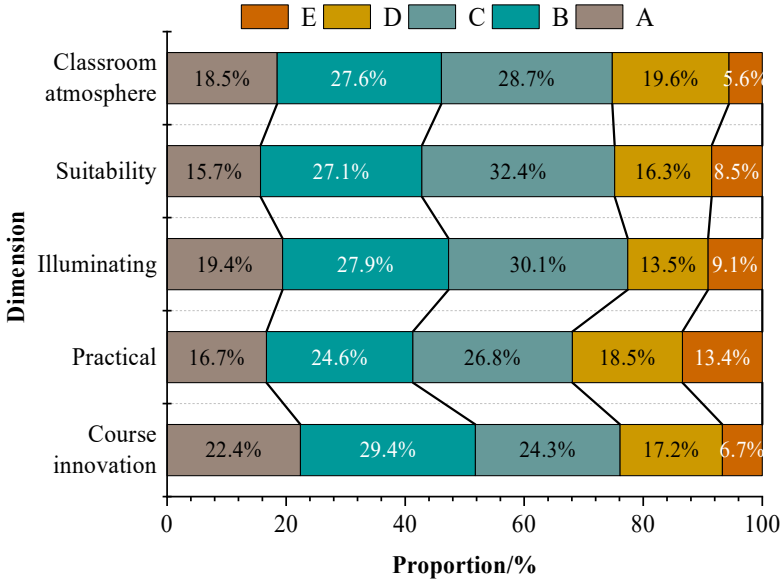

Fig. 4. Investigation result of teaching satisfaction

3.2.3. Formulation of research hypotheses. By analyzing the results of the questionnaire of the survey on the status quo of the level law literacy course for secondary students, the research hypotheses are put forward:

1) Case teaching of level drawing can effectively stimulate students' interest in learning and cultivate positive learning attitudes.

2) Case study teaching of plain drawing can effectively improve students' skill mastery and practical ability in the course.

3) Case study teaching of plain drawing can effectively improve the overall teaching degree of students.

4. Discussion of the results of the action research

After experiencing a period of action research on case study teaching of plain drawing literacy, SPSS statistical software was used to organize and analyze all the data during the research process, including the pre- and post-test data of the questionnaire and the pre- and post-test data of the achievement test of the first and second classes of the building engineering construction.

4.1. Analysis of the results of the questionnaire

By comparing and analyzing the survey of the pre- and post-test questionnaires of the first class of building engineering construction, we understand whether there is any significant difference in the learning attitude, skill mastery and teaching satisfaction of the students of the first class of building engineering construction after the case study teaching of plain drawing. The descriptive statistics of the dimensions of the pre- and post-tests of the action research are shown in Figure 5, where the higher the mean score, the better the current status of students' learning, and the smaller the standard deviation, the smaller the gap between students.

The mean values of students' learning attitude, skill mastery and teaching satisfaction were 2.57, 2.68 and 2.70 respectively before the action research, and 3.79, 3.95 and 3.91 respectively after the action research, and it can be seen from the scores of the mean values of the pre- and post-tests that the scores of the post-tests are higher than those of the pre-tests, which means that the students' attitudes towards learning to learn leveled graphs and maps improved significantly and the skill The degree of mastery has also improved significantly, and in the process of mastering the vocational

skills of level drawing, students have the ability to analyze and solve problems to a certain extent, and at the same time, the satisfaction of teaching has also been improved.

The standard deviations of the learning attitude, skill mastery and teaching satisfaction of the students in the first class of building engineering construction before the action research were 0.532, 0.526, 0.563 respectively, and the standard deviations after the action research were 0.418, 0.433, 0.427 respectively, and the comparison of the standard deviations of the dimensions can be seen from the comparison of the standard deviations of the dimensions that the standard deviations of the three dimensions have been reduced to varying degrees, which indicates that the building Engineering Construction class 1 students who had poor learning status of leveled drawing in the previous period, also made significant progress.

Fig. 5. The descriptive statistics of each dimension before and after the action study

In order to further verify the significance of the change in the current status of students' learning of plain drawing, the researcher conducted a paired-sample t-test, which indicates that there is no significant difference in the current status of students' learning between the pre and post-tests if the significance (two-tailed) value of the t-test ($P > 0.05$) is significant, and, on the contrary, a significant difference in the current status of students' learning between the pre and post-tests if the significance (two-tailed) value of the t-test ($P < 0.05$) is significant and the P The closer the value is to 0 means the higher the significance.

The results of the paired samples t-test for the pre- and post-test are shown in Table 1. In terms of the overall pre- and post-tests, the mean difference between students' pre- and post-tests is 1.23, with a t-value of -10.186 and a significance (two-tailed) of $P = 0.000 < 0.01$, which indicates that at the 1% significance level, there is a significant difference between the students' current status of learning of leveled drawing before and after the action research, and similarly there is a significant difference between the students' attitudes towards learning, skill mastery and teaching satisfaction in each of the dimensions of the study. It indicates that there is a significant improvement in the current situation of students' plain drawing learning after the action research in the first class of building engineering construction, and the proposed hypothesis is verified.

Table 1. Test results of the test pairs of the matched samples

Matched sample test

	MD	SD	SE	t	Df	Sig.(Double tail)
Learning attitude (after-before)	1.22	0.433	0.158	-10.269	50	0.000
Skill mastery (after-before)	1.27	0.372	0.171	-8.461	50	0.000
Satisfaction (after-before)	1.21	0.438	0.136	-9.363	50	0.000
Overall (after-before)	1.23	0.263	0.122	-10.186	50	0.000

4.2. Comparative analysis of test scores

In order to test whether the case study teaching of plain law literacy has a significant effect on improving the plain law literacy of secondary students, after the action research, the students in the two classes were tested for their achievements, and the results of the statistical analysis of the pre- and post-test scores are shown in Figure 6. There is no significant difference between the average scores of the two classes before the action research, indicating that the level of the students in the two classes is comparable to the level of plain drawing literacy. After one semester of teaching the case study of plain drawing, the post-test scores of the students in the first class of Building Engineering and Construction were significantly improved, with the average score being 4.36 points (5.57%) higher than that of the second class of Building Engineering and Construction and 6.49 points (8.52%) higher than that of the pre-test score, and the standard deviation of the scores decreased at the same time. It can be seen that the case study teaching of plain drawing can effectively stimulate students' interest in learning, skill mastery and improve teaching satisfaction, and at the same time, it also has a positive effect on students' academic performance and can reduce the internal differences among students.

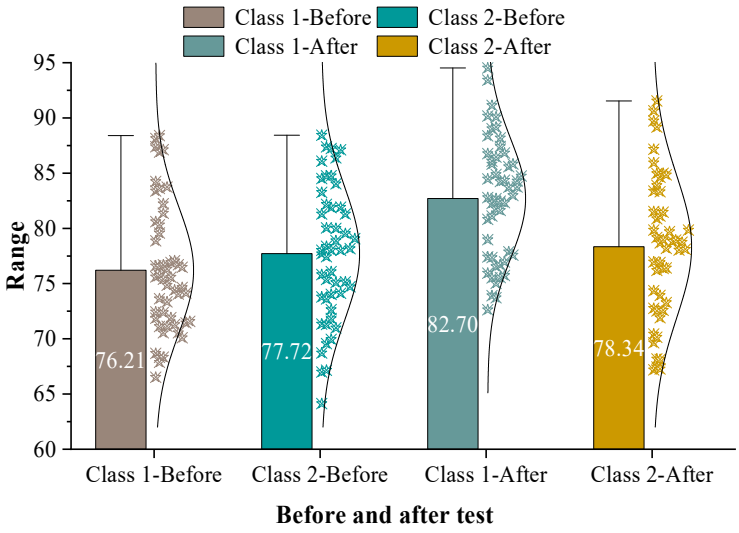

Fig. 6. Statistical analysis of the test results before and after

In order to analyze whether there was a significant change in the test scores of the students in the two classes before and after the action research, an independent samples t-test was conducted on the test scores of the students in the two classes. The independent samples t-test for the pre- and post-test scores is shown in Table 2. The significance of Levine's variance equivalence test in the pre-action test scores P = 0.305 > 0.05 and the significance (two-tailed) P = 0.432, both of which are greater than 0.05, suggests that there is no significant difference in test scores between the two classes before the action research. Levine's variance equivalence test significance P = 0.148 > 0.05 in the test scores after the action research, therefore equal variances are assumed, and the significance (two-tailed) of equal variances is assumed to be P = 0.014 < 0.05, which indicates that there is a significant difference in test scores between the two classes after the action research, and that the Building Construction Class 1 is significantly higher than the Building Construction Class 2, which

suggests that the case study of leveled drafting has a significant impact on improving the students' performance in plain drawing literacy has a positive contributing effect.

Table 2. Independent sample T test of test results

		Levin variance equivalence test		Average equivalent t test				
		F	Sig	t	Df	Sig.(Double tail)	SD	SE
Before	Assumed equal variance	0.032	0.305	-0.388	98	0.432	-0.305	2.188
	Unassumed equal variance			-0.388	97.251	0.162	-0.305	2.334
After	Assumed equal variance	3.424	0.148	2.302	98	0.014	4.348	2.302
	Unassumed equal variance			2.298	96.435	0.012	4.348	2.199

5. Conclusion

Under the dual background of the development of the construction industry and the reform of college education, the college level drawing course should be optimized for teaching based on the characteristics of the course. This paper puts forward the case teaching ideas and methods of leveling drawing, and takes the students of a higher vocational school in X city as a sample for teaching practice.

Through the questionnaire survey on the current learning status of the level law literacy chart, found that the current level law literacy chart course exists in the students' learning attitude is not positive, skill mastery to be improved and teaching satisfaction to be strengthened and other issues, 53.8% of the students on the level law literacy chart course learning interest is low, more than 58% of the students on the level law literacy chart skill mastery can be difficult, and more than 51% of the students of the course is not high satisfaction with the teaching.

After the action research, the first class of building construction using case studies of plain drawing was improved in both learning status and learning achievement. The students' mean scores on learning attitude, skill acquisition and teaching satisfaction increased by 1.23 overall, an increase of 46.24%, and both overall and in each dimension showed a significant difference from before the action research at the 1% level. The students of Class I of Building Construction had 5.57% higher scores on plain law literacy drawings than the students of Class II, as well as an increase of 8.52% from the pre-instructional practice. Case teaching of plain law literacy drawing can stimulate students' learning interest, help students understand and master the knowledge system structure of the course, and promote the improvement of students' academic performance.

In the teaching of flat law literacy map, the majority of teachers should actively change the concept of teaching, fully combined with the actual situation of students and learning ability targeted application of teaching measures. At the same time to strengthen the interaction with students, closer to teachers and students, so that teachers have a more in-depth understanding of students, mastery of the learning situation, so as to lay the foundation for the improvement of students' literacy, map reading ability.

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