Scholar Publishing Group
International Journal of Engineering Technology and Construction
https://doi.org/10.38007/IJETC.2021.020401
ISSN 2789-7176 Vol. 2, Issue 4: 1-9

"Student-centered" Teaching Reform and Innovative Practice of Water Conservancy and Hydropower Engineering

Shinichi Satoh

McGill University, Canada

Keywords: Water Conservancy and Hydropower Engineering, Student-centered, Teaching Reform, Innovative Practice

Abstract: Practical teaching is a crucial teaching link for cultivating applied talents in colleges and universities. It requires university students to integrate the theoretical knowledge they have mastered into practice. It focuses on cultivating students' high sense of innovation and innovation, focusing on students. The improvement of comprehensive quality. The water conservancy and hydropower engineering major is a highly practical subject, which requires high practical ability. However, due to the influence of traditional teaching mode and various objective conditions, many schools still have many problems in practical teaching. There is still a lack of training in students' practical ability. This paper studies the current situation and existing problems of teaching practice in water conservancy and hydropower engineering, and builds a teaching reform practice of water conservancy engineering innovation with "student-centered". Experimental research shows that, compared with traditional teaching methods, the "student-centered" teaching model of water conservancy and hydropower engineering is more excellent in many aspects, especially the students' interest in learning exceeds 15%. It fully reflects the feasibility of the teaching mode designed in this article.

1. Introduction

As China's higher education has changed from elite education to mass education, the number of college enrollments has grown by leaps and bounds. At the same time as the expansion of enrollment in colleges and universities, the educational resources of colleges and universities, especially the expensive experimental equipment, have not been correspondingly developed. As a result, in the actual experimental teaching, due to the large gap in the quality and quantity of experimental equipment, due to experimental time, space, conditions, etc., some experiments cannot be carried out. The lack of practice links in college teaching has become a prominent problem, and

experimental teaching Training students' comprehensive quality and ability has an irreplaceable role in other teaching links. Faced with this situation, the article builds a “student-centered” water conservancy and hydropower engineering practice teaching system, and builds a comprehensive innovative talent training model for water conservancy and hydropower projects based on the cultivation of students' practical ability, emphasizing students' innovative spirit, practical ability and entrepreneurship. The cultivation of abilities. It provides a useful reference for the teaching reform and innovative practice of water conservancy and hydropower engineering.

2. Problems in the Practical Teaching of Water Conservancy and Hydropower

2.1. The Method of Experimental Teaching is Obsolete

At present, the practice teaching of water conservancy and Hydropower Engineering Specialty of Hunan Agricultural University is basically based on professional teaching plan to organize teaching work. Although hydraulics, soil mechanics, water pump and pump station, hydraulic structure model, irrigation and drainage, engineering hydrology and so on, the laboratory teaching ability has reached a certain level, the rate of the experiment has reached 95%, the laboratory teaching has achieved certain effect, but the general teaching mode is still left in the traditional teaching model and the experiment is big. Most of them are set up in combination with the course of theory, and in the time stipulated in the teaching plan. The students are mainly in accordance with the arrangement of the teachers or the steps in the guidance book. The experiment is done in a step by step. The experiment is the same and the result is the only result. Although the students have participated in the experimental teaching activities, the experiment is only used as a skill and imparted in the form of "knowledge", and the students' creative application ability is lacking.

2.2. The Experimental Teaching Method is Backward

At present, most of the experimental teaching in our school is in the demonstration experiment, but the verification experiment, the comprehensive experiment, the design innovation experiment are short, the simulation practice technology is less, the students cannot produce the real experience of the operation process of the enterprise. The experiment teaching is basically still in the "look" experiment rather than the reality. At the end of the test, the ability to practice, create, analyze and solve practical problems cannot get the proper training.

2.3. Professional Particularity Leads to the Difficulty of Practice Teaching.

The practice teaching needs the combination of theory and field guidance. It needs to coordinate the relationship with the relevant units within school and outside school. It should make detailed and detailed arrangements from experimental design, preparation to experiment report, correction of practice report, and the arrangement of students' food and food and accommodation. The work organization is more complicated and the practical teaching is difficult. There are Shaoshan irrigation area, Yueyang Tieshan reservoir and Changsha navigation and electricity hub in the provincial practice teaching base of water conservancy and Hydropower Engineering in our school. The large water conservancy hubs, Three Gorges hubs and Gezhouba Dam power stations in Sichuan and Yunnan are mostly in the provinces, and most of them are construction or built hydropower projects in remote places, three or four The teacher, with hundreds of students who had never experienced the construction site, not only had to go through the lame on the road, but also in the narrow construction site of the remote mountains and mountains, and in the face of all kinds of large equipment and three-dimensional aerial and underground work, the safety of the students and

the safety of the internship. Prominent, once problems arise, the teacher is bound to shoulder certain responsibilities. This has greatly increased the pressure and difficulty of the work of the internship organization, and the main task of the instructors is to be a good security officer and a nanny, and to put the imparting knowledge to the next, which not only restricts the exertion of teachers' ability, but also reduces the effect of practice teaching.

2.4. Lack of Practice Base Construction, Internship Site Contact Difficulties

The field practice base of water conservancy and hydropower is very few, which makes the students' graduation practice must find their own internship units, and most of the units do not want to receive student internship, so that some students cannot find the internship, but in order to deal with the school, the practice ability and actual operation level can only be developed. It's a dead paper. As far as it is concerned, this is a common problem in most water and water conservancy and hydroelectric schools. It is an important "bottleneck" that the practice teaching will be affected by the practice of students and the effect of practical teaching.

3. The Countermeasures for the Reform of Practical Teaching in Water Conservancy and Hydropower Engineering

3.1. Strengthen the Cultivation of Students' Practical Ability and Reform the Practical Teaching System.

According to the knowledge structure and capability structure of post group oriented graduates, the vocational ability of graduates must be further analyzed. Through extensive investigation and scientific classification analysis, 24 major categories and 131 professional abilities (construction technology direction) for the graduates of water conservancy and hydropower construction engineering are clearly defined. On this basis, in order to meet the requirements of professional ability, the practice teaching system characterized by "stratified training, progressive progressive and gradual improvement" is formulated, and the practical teaching system is divided into three levels, such as the training of professional basic skills, the cultivation of professional individual competence, and the cultivation of professional comprehensive ability. The basic skills training is composed of experimental and practical training courses. It mainly trains students to read the basic professional skills of water conservancy and hydropower engineering drawings, measurement instruments operation, building materials and geotextile experiments. The training of single item training mainly through the teaching or production practice of various courses to train students' ability to enter single work, such as construction work. The ability to work, structural calculation and drawing, hydraulic structure design, construction organization design, project budget and so on. The training of professional comprehensive ability is mainly through graduation design and post training. On the basis of mastering the basic skills of the above two parts, the graduates can comprehensively apply the knowledge and skills to solve the problems in production practice. Problems can be directly related to production after graduation.

3.2. Construct the Quality Assurance System of Practice Teaching, and Reform the Practice Teaching Assessment Method.

To establish the organizational guarantee system for the quality of practical teaching. The establishment of a coordinated and coordinated practice teaching organization system, through the post responsibility system to clear the relations of the organizations at all levels, the tasks and responsibilities, so that the decision-making level, management, and the executive layer are clear.

A definite division of labor. The college mainly strengthens the function of the four organization: one is the decision-making function of the leading leader; the two is the management, coordination and inspection function of the educational administration department; three is the organization and implementation function of the department level teaching management organization; and the four is the guidance, inspection, management and executive function of the practice teaching guide group. In the whole practice teaching organization system, it constitutes an organic whole with clear responsibility, close connection and complementing each other. It provides a powerful organization guarantee for improving the quality of practice teaching.

3.3. Strengthen the Construction of the Training Base in the School

The main function of the campus training base is to carry out the basic skills training of the practical post groups that are systematic, standardized and simulated in a purposeful, planned and organized way. The construction of the training base is as close to the front line of production, technology, management and service as possible, and striving to embody the real occupational environment; to select the comprehensive production training projects that follow the development frontiers of the times, to embody the new technology and new technology, to aim at the high technology content and the professional post of the new technology industry, which are lacking in the actual operating personnel; The openness of the environment and the overall design can not only be the basic skill training place for the students, but also can undertake the training tasks of all kinds of professional skills at all levels, make full use of the limited resources, save the capital to the maximum, and make the training base suitable for the construction as much as possible, and can carry on the multidisciplinary comprehensive training. The relevant specialties are as common as possible.

4. Training Mode of Compound Talents for Water Conservancy and Hydropower Projects Based on International Engineering Education Accreditation

The establishment of higher engineering education certification system, participation in international engineering education certification, and the reform of education and teaching under the system of international engineering education certification are an important measure for the reform and system innovation of Higher Engineering Education in China, and also the motive force to promote the reform of higher engineering education and education in China. Under the background of international engineering education certification, it is important to improve the education quality of water conservancy and Hydropower Engineering, improve the professional practice ability and system construction, establish a complete teaching system of higher engineering education, and promote the internationalization of Engineering Education in China. The only way for the process of technical personnel.

Under the background of international engineering education certification, the teaching reform and system innovation of water conservancy and hydropower engineering must follow the core concept of engineering education certification, that is, students centered, target oriented, continuous improvement measures and mechanisms, and the form of teaching content, curriculum system and practice system must be formed. We must have quantifiable indicators and evaluate feedback and continuous improvement with the ability of curriculum achievement, graduation requirements and solving complex engineering problems. The training mode of water conservancy and hydropower engineering professionals involves a perfect cross disciplinary system, a practical teaching system in class and after class and an engineering practice teaching system.

5. Construction of a Practical Teaching System for Water Conservancy and Hydropower Projects with “Student-Centered”

"Student centered" practice training system of water conservancy and Hydropower Engineering, closely combining the requirements of international engineering education certification to the practical ability of engineering specialty, and focusing on the ability of students to solve the complex engineering problems of water conservancy and hydropower projects by using the knowledge and skills they have learned, and to pay attention to the students' practical ability in the course of practice teaching. In the practice teaching system, the training concept of "student centered" should be emphasized in the practice teaching system. The practice teaching content and curriculum system must conform to the development of the students' personality and the cultivation of professional quality. Therefore, the reform of the practice teaching system of water conservancy and hydropower projects with "students as the center" is aimed at cultivating advanced engineering technicians with innovative consciousness, environmental awareness and good quality of engineering.

Combining with the students' engineering practice ability and engineering practice background, the author has gradually formed a "integrated, three level" practice teaching model of water conservancy and Hydropower Engineering in the course of practical teaching, combining the teaching and management of water conservancy and hydropower engineering. In the practice teaching system of water conservancy and Hydropower Engineering, the three-dimensional interaction between professional teaching and engineering practice is carried out, and the training of applied engineering talents with innovative and environmental awareness and good quality of engineering is the core goal of practical teaching. The training system of professional knowledge and skills, the construction of engineering training platform and the feedback mechanism of continuous improvement are three levels of "student centered" practice training system. Through the training process of "four years and four cycles", the training of applied advanced engineering technology talents with international vision and good engineering quality is full. The need for social and economic development in the region is also conducive to participating in international competition.

6. Water Conservancy and Hydropower Engineering Teaching Evaluation Model Based on Fuzzy AHP Theory

6.1. Determine Evaluation Factors

Suppose the set of evaluation factors is U: then there is

$$U = \{u_1, u_2 ..., u_n\} \tag{1}$$

In formula (1), ui is each evaluation factor.

$$U = \{u_1, u_2\} = \{\text{Non-quantitative evaluation}, \text{Quantitative evaluation}\} \tag{2}$$

6.2. Determine the Weight of Evaluation Factors

In order to compare each factor or index pairwise to obtain the relative weight, we introduce the concept of relative importance scale and adopt the 1-9 proportional scale method. Factor i and factor j respectively represent two factors to be compared or two indicators to be compared under a certain factor. The matrix formed by the scale aij is a pairwise comparison matrix.

6.3. The Consistency Check of the Comparison Matrix

By calculating the maximum eigenvalue λmax, the consistency index C.I. and the consistency ratio C.R., to check whether the consistency of the comparison matrix established above meets the requirements.

$$\lambda_{\max} = \frac{1}{n}\sum_{i=1}^{n}\frac{a_{ij}A_i}{A_i} \tag{3}$$

$$C.I. = \frac{\lambda_{\max} - n}{n-1} \tag{4}$$

$$C.R. = \frac{C.I.}{R.I.} \tag{5}$$

The consistency index of the inverted matrix generated randomly is called the random index (R.I.), and its value increases as the order of the matrix increases.

6.4. Final Learning Evaluation Score Result

The quantified non-quantitative learning activity evaluation scores can also be calculated by the weighted average method like the quantified learning activity evaluation scores, so as to obtain the final network learning evaluation score U. which is:

$$U = u_1 \bullet A_1 + u_2 \bullet A_2 \tag{6}$$

7. "Student-centered" Water Conservancy and Hydropower Engineering Teaching Experiment Research

7.1. Experimental Protocol

In order to make the experiment of this article more scientific and effective, this experiment compares and analyzes the traditional teaching mode of water conservancy and hydropower engineering with the "student-centered" teaching mode of water conservancy and hydropower researched in this article. In this experiment, by going deep into the water conservancy and hydropower engineering major of a university in a certain place, and conducting a questionnaire survey on juniors and above, juniors have completed most of the courses in this major, which can make the experimental data more scientific. Use the analytic hierarchy process to analyze the experimental data. On this basis, this article conducts face-to-face interviews with relevant professional teachers on the performance of the "student-centered" teaching reform studied in this article. This experiment uses a ten-point scoring system. In order to ensure the universality of the experimental data, the gender ratio of the teachers interviewed this time is equal.

7.2. Research Methods

Questionnaire survey method: This article sets up targeted questionnaires by asking relevant experts, and uses a semi-closed method to investigate students, the purpose of which is to promote the correct filling of the students under investigation.

Field investigation method: This research conducted an investigation and collected data on the teaching mode of the water conservancy and hydropower engineering major of a university in a

certain place. These data provided reliable support for the final research results of this article.

Analytic Hierarchy Process: Use Analytic Hierarchy Process to analyze and count the research results of this article.

8."Student-centered" Water Conservancy and Hydropower Engineering Teaching Experiment Analysis

8.1. Comparative Analysis of Teaching Mode

In order to make this experiment more scientific and effective, this experiment conducted a questionnaire survey of junior and above students majoring in water conservancy and hydropower engineering. The data obtained are shown in Table 1.

Table 1. Comparative analysis of teaching mode

	Teaching facilities	teaching method	Learning interest	Others
New	71.2%	73.6%	68.4%	66.8%
Traditional	60.7%	59.3%	52.9%	52.3%

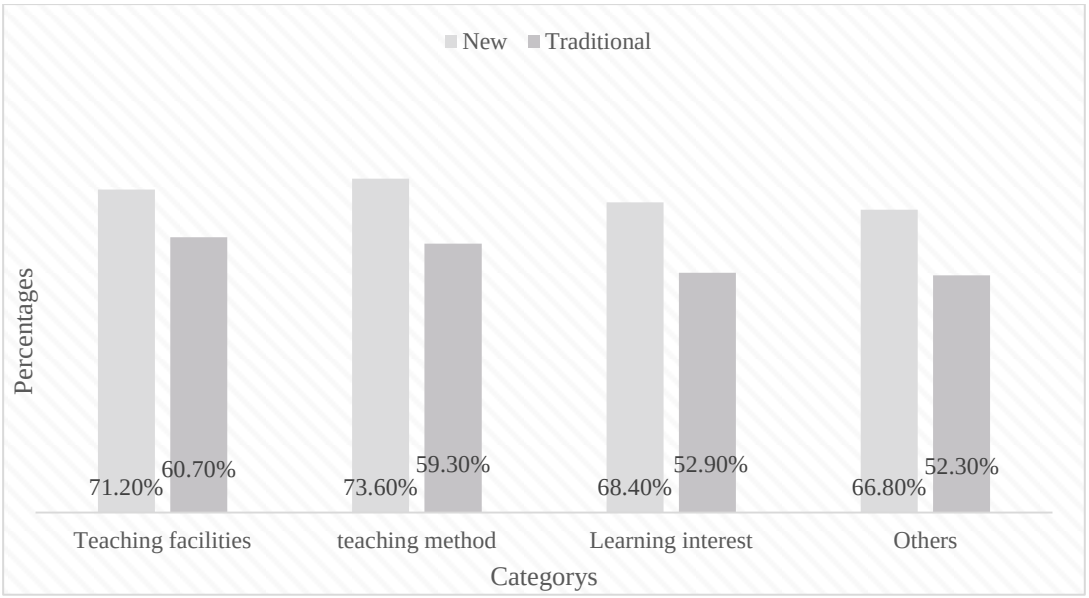

Figure 1. Comparative analysis of teaching mode

It can be seen from Figure 1 that compared with the traditional teaching method, the "student-centered" water conservancy and hydropower engineering teaching model is more excellent in many aspects, especially the students' learning interest exceeds 15%. It fully reflects the excellent performance of the teaching mode designed in this article.

8.2. "Student-centered" Water Conservancy and Hydropower Engineering Teaching Performance Analysis

In order to further research and analyze this experiment, this paper conducts face-to-face interviews with teachers of related majors and records the data, and organizes the recorded data, as

shown in Table 2.

Table 2. "Student-centered" water conservancy and hydropower engineering teaching performance analysis

	Learning efficiency	Learning interest	education resources	Others
Man	7.82	7.94	8.21	6.63
Woman	6.79	7.06	7.78	5.69

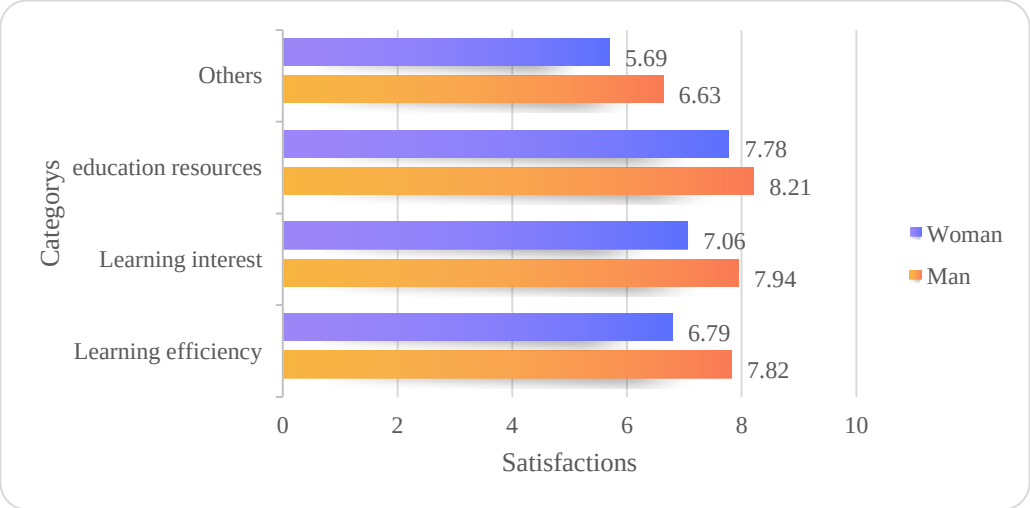

Figure 2. "Student-centered" water conservancy and hydropower engineering teaching performance analysis

It can be seen from Figure 2 that the evaluation of the “student-centered” teaching mode by teachers of water conservancy and hydropower engineering related majors is above 5, and the average evaluation of learning resources is about 8. This fully reflects this article The feasibility of the research content.

9. Conclusion

We should pay more attention to the cultivation of students' innovative spirit, practical ability and application ability, strengthen the construction of curriculum construction, information construction, teaching material construction and practice training base, focus on training the practical ability of professional students, and build a model for training the complex talents of water conservancy and hydropower projects based on the certification of international engineering education. The global competitive environment should set up a professional training system based on "student centered", "target oriented" and "persisting in continuous improvement", and build a system and mechanism for continuous improvement of education and teaching. In order to highlight the training of students' practical ability and integrate, integrate and deepen the achievements of the existing teaching reform, a practical training system for water conservancy and hydropower projects is formed with the "student as the center", and good results have been achieved.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Zhang D Y. Influence of water conservancy and hydropower engineering on fish and protection measures. Water Resources Protection, 2011.

[2] Qin Y R. Analysis of Basic Construction Technology of Water Conservancy and Hydropower Engineering. Heilongjiang Science, 2015.

[3] Shuquan X U. Deepening innovation of water conservancy technology and enhancing water conservancy management ability. Water Resources & Hydropower Engineering, 2014.

[4] Yang J, Yao C, Liu C, et al. Exploration on virtual simulation practice teaching for the major of water conservancy and hydropower engineering. Journal of Architectural Education in Institutions of Higher Learning, 2017.

[5] Liu D H. Application of Inventor 3-D Design Software to Water Conservancy and Hydropower Engineering. Journal of Yangtze River Scientific Research Institute, 2012.

[6] Liang Z. Investigation and Analysis of Practical Teaching Effect of Water Conservancy and Hydropower Engineering Case Study of Chongqing Jiaotong University. Journal of Chongqing Jiaotong University, 2016.

[7] He W, An M, Yuan L. Analysis of the Ecological Migration's Negative Benefit of China's Large-Scale Water Conservancy and Hydropower Projects under the Perspective of Low Carbon. International Asia Conference on Industrial Engineering and Management Innovation. 2015:93-97. https://doi.org/10.2991/978-94-6239-100-0_17

[8] Zhong Z. Research on Water Conservancy and Hydropower Engineering Foundation Treatment Technology. Science & Technology & Innovation, 2015.

[9] Lin Y U, Guo W, Chen Y. A Preliminary Study on the Merger of Resettlement Endowment Security of Water Conservancy and Hydropower Engineering and Social Endowment Insurance in Sichuan Province. Water Power, 2017.

[10] Liu H. Water Conservancy and Hydropower Engineering Foundation on Karst Water Inflow and Prediction. Science & Technology & Innovation, 2015.

[11] Zhang S, Fan J, Jiang L. Construction of the Practical Teaching System of Water Conservancy and Hydropower Engineering in Independent Colleges:A Case Study of Tianjin University Ren'ai College. Tianjin Science & Technology, 2016.

[12] Luo L, Jinchun H E, Liu J. Teaching reform and practice of hydraulic reinforced concrete structure. Journal of Architectural Education in Institutions of Higher Learning, 2017.

[13] Qiao J, Zhong H, Peng S. Water Resources and Hydropower Engineering Major Governance Issues in the Construction of Hydraulic High Slope. Science & Technology & Innovation, 2014.

[14] Chen G W. Analysis on Electromechanical Technology of Water Conservancy and Hydropower Engineering. Journal of Jiamusi Vocational Institute, 2018.