ISSN 2663-8169 Vol. 5, Issue 15: 153-156, DOI: 10.25236/IJNDE.2023.051525

The application of online and offline mixed teaching mode in hydraulics experiment teaching

Qiang Zhang*, Zhicheng Xi, Baiquan Chen

College of Hydrodynamic and Ecology Engineering, Nanchang Institute of Technology, Nanchang, 330099, China
**Corresponding author*

Abstract: *With the continuous development of internet technology and online education platforms, the mixed teaching mode of online and offline has become a trend and choice. This article discusses the application of mixed teaching mode in hydraulic experiment teaching, aiming to solve the problems existing in traditional offline hydraulic experiment teaching. We explore the assessment problem for mixed hydraulic experiment teaching mode, and analyze the implementation effect of mixed teaching mode in hydraulic experiment courses. Mixed teaching mode of online and offline can further improve the teaching quality of hydraulic experiment courses and provide reference for other similar courses.*

Keywords: *online and offline, mixed teaching mode, hydraulics experiment teaching, online assessment, implementation effect*

1. Introduction

With the rapid development of internet technology, traditional educational models are facing certain challenges. Particularly during the pandemic period, online education has been widely applied and developed. The rise of online classroom mode provides students with a more flexible and convenient way of learning, while reducing learning costs and improving learning efficiency. However, in some areas, online teaching faces challenges in terms of adaptability and effectiveness. Hydraulic experiment courses in the field of water conservancy and hydropower engineering are typical examples.

Hydraulic experiment is an important teaching component in the hydraulic course. It not only helps students to fully comprehend the required theoretical knowledge, but also cultivates their hands-on practical skills. As a modern scientific and technological talent, one not only needs to possess practical abilities, but also research-oriented qualities. The experiment teaching plays a crucial role in fostering these talents by enabling students to learn basic skills such as experimental design and data processing, as well as cultivating their innovative consciousness and ability.

The traditional teaching mode of hydraulic experiment encounters some issues such as limited teaching resources and insufficient experimental instruments [1]. To solve these problems, the mixed online and offline teaching mode has emerged. This article aims to explore the application of this mixed teaching mode in hydraulic experiment teaching and propose a teaching reform plan to improve the quality of hydraulic experiment teaching.

2. Problems existing in the experimental teaching mode of offline hydraulics

In the major of water conservancy engineering, offline hydraulics experiment teaching has always been a very important teaching method. However, there are also some problems in the offline hydraulics experiment teaching. Due to the possible existence of many uncertain factors, coupled with human error and the complexity of the experiment, it is difficult to reproduce the experimental data, which further leads to the reliability of the experimental results [2].

Offline hydraulic experiment usually requires a long period of experiment preparation and execution, which may affect students' learning efficiency. Moreover, since each step, such as checking and recording experimental data, is required during the experiment, students may not fully understand the essence of the experiment, resulting in a more vague understanding of the bridge between theory and experiment as well as the relationship diagram of subject knowledge.

ISSN 2663-8169 Vol. 5, Issue 15: 153-156, DOI: 10.25236/IJNDE.2023.051525

Although offline hydraulic experiment teaching has its unique learning characteristics, the teaching mode also encounters certain challenges. To address these issues, we can explore improving experiment standardization and semi-virtualization. Furthermore, we should continuously update teaching tools and introduce advanced technologies such as deep learning, big data, artificial intelligence, and virtual reality to optimize traditional teaching modes and develop new teaching methods. By adopting more forward-looking teaching approaches, we can enhance students' subject literacy, practical ability, and competitiveness.

3. The application of online and offline hybrid teaching mode in hydraulics experiment teaching

3.1 Experimental teaching content and objectives

Taking the water conservancy and hydropower engineering major as an example, the hydraulic experiment course consists of 16 teaching hours. Each experiment takes 2 teaching hours, with a total of 8 experimental projects. The mandatory projects for hydraulic experiments include static hydraulic experiment, energy equation experiment, momentum equation experiment, Reynolds experiment, along-the-channel head loss experiment, local head loss experiment, Venturi experiment, and orifice experiment. For students with extra capacity, they can choose some optional experimental projects, such as Pitot static tube speed measurement and calibration factor determination experiment, Darcy's permeability test, water hammer comprehensive experiment, siphon principle experiment, water surface curve experiment, weir flow experiment, and numerical simulation of water surface curve experiment, which consist of seven different experimental projects.

Through experimental teaching, students can master the general rules of fluid motion and the relevant basic concepts and theories, as well as necessary analysis and calculation methods and certain experimental techniques and skills. This lays a necessary foundation for the study of professional courses, solving hydraulic problems in engineering, acquiring new knowledge, and conducting scientific research. By observing various water flow phenomena and measuring relevant hydraulic elements, students can increase their intuitive understanding, verify, consolidate and broaden theoretical knowledge, master experimental methods, improve their ability to analyze and interpret experimental data, and draw reasonable and effective conclusions. Through combining experimental operation and in-depth analysis of hydrodynamic theory, related natural science knowledge and principles are taught, allowing students to appreciate the charm of the water conservancy profession.

3.2 Online teaching segments

In the online teaching segment, various teaching methods can be used. Regarding theoretical knowledge and experimental operation of hydraulic experiments in the hydraulic and hydropower engineering field, the Chaoxing Learning Platform can be utilized to establish online courses and upload videos explaining the principles, online and offline operations, and more related to 8 hydraulic experiments. This is to provide students with guidance for experimental operation and theoretical knowledge. As for online experiment operations, the hydraulic virtual simulation experiment platform can be employed [3].

To achieve better mixed learning, online theoretical knowledge and offline experiments should be combined, so as to help students apply theory into practice more effectively. In conducting experimental teaching, it is recommended to inform students about the experiment content and requirements in advance, guide them to learn experiment content and operation by watching videos, and conduct online experiments on the hydraulic virtual simulation experiment platform after watching the videos. After completing the online experiments, students should upload experiment reports on the Chaoxing Learning Platform.

3.3 Offline experiment segments

Through online learning and online experimental operations, students have gained a certain understanding of hydraulic experiments. In the offline experimental practice segment, teachers do not need to repeat the principles and operating procedures of hydraulic experiments. Instead, they should explain the key and difficult points of the experiment according to the students' online learning situation, enabling them to fully understand the experiment content. At the same time, teachers should guide

ISSN 2663-8169 Vol. 5, Issue 15: 153-156, DOI: 10.25236/IJNDE.2023.051525

students to collect and analyze data through actual operations, helping them to further master the theoretical knowledge. In this way, better application and understanding of the knowledge points can be achieved [4].

The mixed learning mode, combining both online and offline teaching, can reduce time and space constraints while meeting the learning needs of different students. In addition, the interactive teaching models, such as the discussion area and the Q&A area provided by the Chaoxing Learning Platform, can be utilized to further improve the effectiveness of hydraulic experiment teaching.

4. Assessment of hydraulic experiment course

Hydraulics laboratory experiment assessment is an objective evaluation and feedback of students' learning achievements in the hydraulics laboratory experiment course, which can help students consolidate their learning achievements, improve their experimental operation ability and comprehensive quality, and lay a solid foundation for future study and scientific research. The assessment of hydraulics experiment course includes online assessment and offline assessment. The online assessment is mainly to watch the length of students' online video and each online experiment report. The offline assessment is mainly to watch the students' experimental attendance, experimental operation, experimental report and so on. Taking the major of water conservancy and hydropower engineering as an example, the assessment method of hydraulics experiment course is carried out according to 15 % online score, 15 % offline usual score and 70 % experimental report score.

4.1 Online assessment

Online grades mainly reflect on the duration of watching videos online and the status of each online experiment report. The duration of students watching the principle and operation videos is recorded on StudyTong, which can reflect the students' online learning status. After completing the virtual simulation experiment, students submit the experiment report online. The experiment report mainly includes experimental results, data analysis, and conclusions, etc. Students are required to pay attention to standardization, accuracy, and completeness. This evaluates their understanding and mastery level of the hydraulic experiment content[5].

4.2 Offline assessment

Offline grades mainly reflect on experiment attendance and experiment operation. The experiment report grade depends on the processing and analysis of experimental data. In terms of experiment operation ability, students need to master the use of experimental instruments and experimental operation steps proficiently and accurately collect and process data. Offline experiment reports are an important part of the assessment of the hydraulic experiment course. Students are usually required to write an experiment report after completing the experiment. The content of the report includes experimental purpose, experimental principle, experimental instruments, experimental steps, experimental results, data analysis and conclusions, etc. Through the writing of the experiment report, students can not only combine theoretical knowledge and experimental operation skills organically but also exercise their ability to conduct scientific research and write papers[6].

5. Impact analysis of implementation

Compared to the traditional experimental teaching model, the hybrid teaching model can improve the teaching effect of hydraulic experiment class. Virtual simulation experiments in hydraulics can more intuitively demonstrate experimental phenomena and principles, improving students' experimental cognitive levels. Offline experiments can help students grasp experimental operation skills. The combination of online and offline experiments can help students better understand the experimental process and principles, improving learning efficiency. The implementation of the hybrid teaching model can improve the effectiveness and efficiency of experimental teaching and better adapt to the future development trend of teaching. Therefore, it has a high value of application and promotion.

The hybrid teaching model is a teaching method with strong practicality and development potential. In the context of large-scale online education and distance education, it will have a wide range of application prospects. The online and offline hybrid teaching mode can better combine online and offline

ISSN 2663-8169 Vol. 5, Issue 15: 153-156, DOI: 10.25236/IJNDE.2023.051525

teaching, transfer the video of on-site experimental operation in the laboratory to online viewing, and realize remote teaching and network guidance between students and teachers, solving the problem of information island in the traditional hydraulic experiment teaching process. Students can learn hydraulic experiment on a broader teaching platform, better use computing and multimedia technology, and better digest and absorb knowledge.

6. Conclusions

The online and offline hybrid teaching mode has a wide range of application prospects in hydraulic experiment teaching. This teaching mode can not only improve teaching effectiveness and efficiency but also better adapt to the future development trend of teaching, which is more advantageous in the context of large-scale online education and distance education. By combining online virtual simulation experiments with offline experiments through online teaching platforms, it can more intuitively demonstrate experimental phenomena and principles, help students better grasp experimental knowledge and operational skills, and obtain more practical experience and experimental data. Through monitoring and evaluation tools, student learning performance and teaching effectiveness can be centralized, and real-time monitoring and feedback can be carried out to improve teaching methods and quality. Therefore, in hydraulic experiment teaching, the online and offline hybrid teaching mode is a teaching mode worth promoting, which can provide students with a better learning experience and practical experience in experiment operation, and contribute to teaching reform and improvement of teaching quality.

Acknowledgments

This work was financially supported by Nanchang Institute of Technology Teaching Reform Research Project (2021JG001, 2020JG050).

References

[1] Q. Xu, Experimental teaching reform of hydraulics in water supply and drainage science and engineering, Shanxi Architecture. 46(2) (2020) 168-169.
[2] Y. Zhang, X.D. Bai, C.Y. Guan, Y. Song, H.M. Kong, Exploration of Hydraulic Experimental Teaching Mode under the Background of New Engineering, Education Teaching Forum. (24) (2019) 269-271.
[3] L. Tang, W.B. Zhang, P. Wang, Discussion on Online Teaching Methods of Hydraulics Course, Education Teaching Forum. (6) (2021) 137-140.
[4] L.H. Chen, J. Wang, Practice and Innovation of Blended Teaching Based on OBE: Taking Hydraulics Course as an Example, Education Teaching Forum. (44) (2021) 110-113.
[5] J. Li, R.Y. Xu, Exploration and Practice on the Construction of First-class Undergraduate Course in Hydraulics at Yangzhou University, Higher Education Form. (8) (2022) 19-21.
[6] Y. Zhang, Research on the Reform of Performance Evaluation Method of Public Physical Education Courses in Colleges and Universities Based on Online and Offline Hybrid Teaching Mode, Contemporary Sports Technology. 12(16) (2022) 184-186.