Research on the Reform and Practice of the "Three Teachings" in IoT Dual High-Standard Professional Group Based on the PAD Class Model

Chen Ning, Zhang Man

Chongqing Open University, Chongqing, China

Abstract: the PAD Class Model, proposed by Professor Zhang Xuexin of Fudan University in 2014, is an innovative teaching methodology. Its core lies in dividing classroom time into two halves, with one half dedicated to teachers imparting knowledge and the other half left for students to engage in interactive discussion and learning. Given the characteristics of the IoT Dual High-Standard Professional Group, such as interdisciplinary nature, practical orientation, innovative thinking, and team collaboration, as well as the practical need for the "Three Teachings" reform outlined in the "Vocational Education 20 Guidelines ", this study focuses primarily on teaching methodology reform, complemented by reforms in teaching materials and teachers. The PAD Class Model was applied to the "Computer Networks" course. The practical results show that this teaching model significantly improves classroom effectiveness and achieves remarkable outcomes in promoting the "Three Teachings" reform, providing new ideas and directions for education and teaching in the IoT Dual High-Standard Professional Group.

Keywords: PAD Class Model; Internet of Things (IoT); Dual High-Standard Professional Group; Three Teachings Reform

1. Introduction

Since 2021, the Ministry of Education of China has issued multiple crucial documents in an effort to thoroughly implement the spirit of the National Education Conference and further enhance vocational education in the new era. These documents aim to comprehensively promote the reform and development of vocational education. Among them, the issuance of the "National Vocational Education Reform Implementation Plan" clarifies the requirements for implementing the "Vocational Education Law of the People's Republic of China, " with the goal of improving the quality of vocational education through a series of reform measures and strengthening its deep integration with industries to meet the new demands of economic and social development. Subsequently, the release of the "Vocational Education Teaching Reform Action Plan (2021-2023)" further outlines the key tasks and measures for reforming vocational education teaching. This plan focuses on reforming teaching content, innovating teaching methods, and fostering teacher development, striving to elevate the overall level and quality of vocational education through comprehensive teaching reforms. Additionally, the issuance of the "Vocational Education Teacher Team Construction Action Plan (2021-2023)" underscores the country's emphasis on the construction of a high-quality vocational education teacher team.

This plan aims to improve the quality of vocational education teachers by strengthening teacher training and evaluation mechanism construction, providing a robust talent guarantee for the high-quality development of vocational education. Furthermore, the release of the "Higher Vocational Education Quality Enhancement Plan (2021-2023)" directly outlines specific requirements and measures for enhancing the quality of higher vocational education. This plan emphasizes strengthening educational and teaching management and evaluation, promoting the close alignment of higher vocational education with industry needs, and cultivating more high-quality technical and skilled talents who meet social demands.

The introduction of these implementation plans and action programs all point to the core goal

of improving teaching quality, particularly the promotion and implementation of the "Three Teachings" reform, which encompasses teaching materials, teachers, and teaching methods. This comprehensive approach aims to drive the high-quality development of higher vocational education.

2. Current Status of the "Three Teachings" in IoT Dual High-Standard Professional Group

As a model of interdisciplinary integration, the IoT dual high-standard professional group exhibits distinctive characteristics, including high practicality requirements, an emphasis on innovative thinking, and a need for collaborative teamwork. However, upon conducting thorough research, we have identified significant shortcomings in its "Three Teachings" status. Firstly, the updating pace of teaching materials lags behind the rapid technological advancements, resulting in a severe disconnect between the content of textbooks and practical application scenarios, making it difficult to meet the demands of industrial development. Secondly, teachers tend to adopt traditional teaching methods that lack necessary innovation, practicality, and interaction, making it challenging to effectively stimulate students' interest in learning and leading to low classroom engagement. Lastly, the integration and utilization of teaching resources appear to be inadequate, which not only hinders the improvement of teaching efficiency but also fails to satisfy the requirements of the dual high-standard professional group for cultivating high-quality talents, let alone meeting the growing professional needs of IoT professionals. Consequently, it is imperative to engage in profound reflection and reforms addressing the aforementioned issues.

As a result, classroom teaching outcomes have highlighted various problems and challenges. Firstly, a significant portion of vocational college students demonstrate a lack of enthusiasm for learning, and they are devoid of the motivation for proactive learning. the diverse student background in vocational colleges means that some students have not developed good study habits and lack the ability for self-directed learning, leading to unsatisfactory learning outcomes and difficulties in achieving anticipated academic

goals. Secondly, a segment of students lacks interest in their majors and exhibits overt feelings of weariness towards their studies. They are devoid of self-awareness and clear goals in learning, often manifesting as indifference and detachment from their courses. This situation may hinder students from gaining a profound understanding of their knowledge and, in extreme cases, may even lead to thoughts of dropping out, adversely impacting their academic and professional development.

Furthermore, students in vocational colleges generally confront the issue of inadequate practical operation skills. Despite the emphasis placed on cultivating such skills in vocational colleges, some students fail to reach the expected level of proficiency due to a lack of sufficient practical opportunities and effective guidance. Consequently, they struggle to meet the actual needs of enterprises upon graduation, thereby undermining their employment competitiveness.

Additionally, issues pertaining to classroom discipline cannot be overlooked. Some students engage in undesirable behaviors such as playing with their phones or sleeping during class, which not only disrupts the classroom order and impacts the learning outcomes of other students but also significantly dampens the enthusiasm and effectiveness of teachers. This negative classroom atmosphere may further exacerbate students' learning problems, creating a vicious cycle.

In summary, vocational colleges confront multifaceted challenges in classroom teaching, necessitating the adoption of effective measures for improvement and enhancement.

3. The PAD Class Model

The PAD Class Model is an innovative teaching model, was first proposed by Professor Zhang Xuexin of Fudan University. Its core concept lies in skillfully dividing traditional classroom time. Specifically, half of the time is dedicated to systematic lectures by teachers, ensuring that students receive core knowledge and information; while the other half of the time is entirely allocated to students for in-depth discussions and exchanges among themselves [3]. This model significantly enhances the interaction between teachers and students, aiming to effectively enhance students' critical thinking and self-learning

abilities.

The PAD Class Model is a creative and well-structured teaching approach that primarily comprises five core stages. the first is the Lecture stage, where the teacher conducts systematic knowledge instruction in the classroom, comprehensively introducing course content and emphases. This stage accounts for half of the class time, ensuring that students receive the core knowledge framework and information. Next is the Internalization stage, where students initially internalize and comprehend the content taught by the teacher during the class, and further deepen their understanding through previewing, reviewing, or completing assignments after class. Following this is the Discussion stage, where students are grouped for discussions to share their understanding and thoughts on the course content. This stage also takes up half of the class time, with each group selecting a representative to summarize their discussion, aiming to exercise students' expression and summarization skills. After the discussion, the teacher provides a summary and feedback, pointing out students' learning outcomes and possible misunderstandings, and further deepening the course content. Finally, comes the Feedback stage, where the teacher gives specific feedback and guidance based on students' discussions and performance, helping them better grasp the knowledge and improve overall learning outcomes.

3.1 Characteristics of the PAD Class Model

The PAD Class Model has demonstrated its unique functions in educational practice, particularly in the following three aspects. Firstly, this model emphasizes student autonomy, requiring students to preview and reflect on the course content before class. This not only helps students gain a preliminary understanding of the course content and prepare for classroom learning, but also effectively cultivates their autonomous learning abilities. After class, students also have ample time for self-directed learning and practice, further honing their independent learning skills through hands-on operation and application. Secondly, this model significantly enhances classroom interaction. Through dedicated classroom discussion sessions, student-to-student and student-to-teacher communication and interaction are greatly facilitated. This multidimensional interaction not only helps students deepen their understanding of knowledge but also effectively expands their thinking and inspires new learning insights. Lastly, by providing every student with an opportunity to participate in the teaching process and express their opinions and insights, this model markedly increases student engagement, thereby boosting their learning motivation and self-confidence. It provides strong support for cultivating well-rounded students.

3.2 Steps to Implement the PAD Class Model

The PAD Class Model is a highly effective teaching methodology that revolves around three core steps.

Firstly, teacher instruction serves as the cornerstone of this model. the teacher delivers lectures on key knowledge points in the classroom, providing students with a clear framework for self-study and offering necessary guidance to help them better grasp the learning direction.

Secondly, classroom discussion is a crucial component of this model. Students are grouped to discuss the content they have learned, actively exchanging their understandings and confusions. the teacher, meanwhile, takes on the role of facilitator and answerer, encouraging students to think deeply and stimulating their enthusiasm for learning.

Thirdly, student internalization and absorption is the key step of this model. After class, students delve into a deeper understanding and assimilation of the learned content through various methods such as reviewing and hands-on practice, truly transforming knowledge into their own abilities and qualities. These three steps complement each other, collectively contributing to the unique charm of the PAD Class Model.

4. "Three Teachings" Reform Based on the PAD Class Model

4.1 Reform of Teaching Methods

The reform of teaching methods lies at the heart of the PAD Class Model, aiming to drive innovation and development in education and teaching. Before the course begins, teachers should clarify the teaching objectives to ensure that students have a clear understanding of the

learning outcomes they need to achieve, thereby laying a solid foundation for the entire teaching process. To achieve this goal, teachers can make full use of technological tools and the flipped classroom teaching strategy. By utilizing advanced technological tools such as online learning platforms and educational software to assist in teaching, not only can teaching methods be enriched, but student engagement can also be significantly enhanced. Additionally, the application of the flipped classroom is crucial, allowing students to engage in autonomous learning through watching videos, conducting experiments, and other methods during class time, while classroom hours are dedicated more to discussions, practice, and deepening understanding, thereby effectively improving learning outcomes.

Moreover, cooperative learning in small groups is also a crucial aspect of the reform of teaching methods. Teachers should actively encourage students to collaborate in groups to complete learning tasks jointly. This approach not only cultivates students' teamwork skills but also enhances their problem-solving abilities. In terms of assessment and grading, each class should encompass both teacher-led instruction and student practice, with a focus on hands-on experimental operations. Instructors should be responsible for completing assessments and grading within the classroom to ensure timeliness and accuracy of evaluations.

Lastly, establishing a teaching resource sharing platform is a significant measure in the reform of teaching methods. By integrating educational resources both within and outside the school, teachers can conduct teaching work more efficiently, further improving teaching quality and effectiveness.

4.2 Reform of Teaching Materials

The reform of teaching materials is an essential component of educational and teaching innovation, with its core lying in ensuring the timeliness and practicality of the content. To achieve this goal, it is necessary to establish a textbook updating mechanism, regularly evaluating and updating the content to ensure that it stays in sync with technological advancements. During the updating process, the involvement of industry mentors in jointly designing new textbooks is crucial, as it not

only introduces cutting-edge industry knowledge but also makes the content more relevant to practical applications.

Furthermore, integrating multimedia resources is a significant direction for textbook reform. Incorporating video, audio, animations, and other multimedia elements into textbooks can make learning content more vivid, engaging, and easier for students to understand and accept. Additionally, introducing electronic textbooks, complemented with experimental videos and electronic documents, is another important measure to enhance the practicality of teaching materials.

Lastly, modular design is another key point in textbook reform. Dividing textbook content into multiple modules, each containing independent knowledge points and skills training, facilitates teachers' flexible selection and organization of teaching content according to their needs. Such a design also helps students learn and master relevant knowledge and skills more targetedly.

4.3 Reform of Teaching Staff

The reform of the teaching staff is a crucial link in improving the quality of education and teaching. To achieve this goal, priority should be given to the professional development of teachers. By strengthening teacher training and exchanges, teachers can be helped to master new technologies, new teaching methods, and the latest industry trends, thereby enhancing their teaching abilities. To this end, teaching exchanges and skills training should be regularly organized for teachers, and opportunities for professional development training should be provided to ensure that they make continuous progress and keep up with the times.

Meanwhile, encouraging teachers to become "double-qualified" teachers is also an important direction for the reform of the teaching staff. This means that teachers should not only possess teaching abilities but also have practical industry experience. In accordance with the requirements of the Ministry of Education's latest version of the "Basic Standards for 'Double-Qualified' Teachers in Vocational Education (Trial)", we should actively promote this implementation and encourage teachers to obtain industry qualifications to enhance their practical capabilities.

To enhance teachers' industry experience, it is necessary to facilitate exchanges between teachers and industries. Through methods such as corporate internships and project collaborations, teachers can gain a deeper understanding of industry realities, which will enable them to better integrate practical aspects into their teaching and improve students' practical abilities. Additionally, making the enhancement of teachers' industry experience a prerequisite for professional title advancement can motivate teachers to more actively engage in industry practices.

Lastly, strengthening the cooperation between schools and enterprises, as well as integrating industry and education, is a crucial aspect of the teaching staff reform. Schools should deepen their collaborations with enterprises, introducing industry mentors and real-world projects to strengthen the development of practical teaching components. Industry mentors can participate in the reform of teaching materials, methods, and teachers, leveraging their practical experience and professional knowledge to provide robust support for educational reform. Simultaneously, they can engage in teaching activities, sharing their industry insights and offering practical guidance to students, thereby helping them better comprehend industry realities and prepare for future careers.

The reform of the teaching staff involves multiple aspects and requires comprehensive consideration and integrated promotion. By implementing measures such as professional development, fostering "double-qualified" teachers, enhancing industry experience, and strengthening school-enterprise cooperation, we can build a high-quality and professional teaching staff, providing a solid foundation for improving the quality of education and teaching.

5. Practical Research

We conducted in-depth practical research by integrating the PAD Class Model with the "three teachings" reform and applying it to the "Computer Networks" course within the IoT Dual High-Standard Professional Group. the implementation of this teaching model has achieved remarkable results, injecting new vitality into the curriculum reform.

During the practical process, we first organized learning groups. In the classroom teaching throughout the semester, we mixed students of different ability levels into groups to facilitate mutual learning and assistance among them. Each group was assigned a leader responsible for organizing in-class discussions. During each discussion, a group member was selected to report on the discussion and experimental operation. This arrangement not only exercises students' presentation skills but also ensures that every student actively participates in learning, fostering a positive learning atmosphere.

Given the highly practical nature of the "Computer Networks" course, we implemented modular teaching and developed electronic textbooks. We modularized the course's knowledge points, with each class session lasting for 3 class periods. One class period was dedicated to lecturing on theory, ensuring students had a solid understanding of the basic knowledge. Another class period was for self-study and discussion, giving students the opportunity to delve deeper into concepts and exchange ideas. the final class period was for experimental operation reports, allowing students to apply theoretical knowledge to practical scenarios. Simultaneously, we compiled a comprehensive electronic textbook that included experimental videos, documents, and commands, facilitating self-study and discussions among students. This teaching approach integrated theory with practice, better aligning with students' learning needs and enhancing their interest and motivation in the subject.

To strengthen quality assurance, each class session comprises three segments: theoretical teaching, in-class discussion, and experimental reporting. Experimental reporting requires the submission of assignments for evaluation, allowing us to better understand students' learning progress and ensure the quality of their learning depth. This assessment method also prompts students to place greater emphasis on the practicality and applicability of experimental operations, further enhancing their hands-on skills.

In summary, the integration of the PAD Class Model with the "three teachings" reform in the "Computer Networks" course has not only boosted students' interest and motivation but also honed their presentation skills and practical abilities. Modular teaching and the development of electronic textbooks have

successfully integrated theory with practice, aligning more closely with students' learning needs. Moreover, the measures to strengthen quality assurance have ensured the depth and effectiveness of students' learning. the implementation of this teaching model has provided new insights and directions for the curriculum reform of the IoT Dual High-Standard Professional Group.

6. Conclusion

This study successfully integrated the PAD Class Model with the "three teachings reform" and applied it to the "Computer Networks" course within the IoT Dual High-Standard Professional Group. Through a series of innovative measures, such as organizing learning groups, implementing modular teaching and electronic textbooks, and strengthening assignment submission and evaluation, notable teaching outcomes were achieved. the application of this teaching model not only promoted comprehensive reforms in teaching materials, teachers, and teaching methods but also significantly enhanced students' learning motivation and practical abilities. Students assisted each other and progressed together in group learning, while modular teaching and electronic textbooks tightly integrated theory with practice. Additionally, assignment submission and evaluation ensured steady improvements in learning quality. the successful application of the PAD Class Model in IoT professional education provides new ideas and approaches for the high-quality development of higher vocational education, worthy of further promotion and exploration.

References
[1] Liu Hongmei. Reform of Information-Based the PAD Class Model: A Case Study of Geely College [J]. Computer Knowledge and Technology, 2021(17):190-193.
[2] Gu Jun. Research on the Implementation Paths and Methods of Internal Audit Transformation in Colleges and Universities under the Background of Educational Reform: Taking Higher Vocational Colleges as an Example [J]. Budget Management and Accounting, 2023(11):67-72.
[3] Ye Shaolan. A Preliminary Study on the Application of "Blended PAD Class Model" Model in Micro-writing Teaching of Chinese in Vocational High Schools [J]. Road to Success, 2022(06):67-69.
[4] Mo Jiaye (Supervisor: Li Mengzhu). Practical Research on Improving Classroom Participation of Secondary Vocational School Students with PBL Teaching Method [D]. Guangxi Normal University Master's Thesis, 2021(06).
[5] Lu Yanhui (Supervisor: Huang Wei). A Narrative Study on the "Dual" Teaching Competence Development of a "Dual-Qualification" Teacher in a Secondary Vocational School [D]. Guangdong Polytechnic Normal University Master's Thesis, 2023(11).