



Research on "School-based Characteristic" Mixed Teaching Mode in Higher Education Under the Background of Informatization Education

--Taking University Physics Experiment Teaching as an Example

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Abstract. Under the promotion of teaching reform in the background of informatization, the teaching mode of higher education has been greatly impacted. In order to meet the needs of the information age for the cultivation of talent quality, the model of teaching and learning in higher education needs to continue to explore and study combined with the development of information technology. Although there are great differences in the characteristics of different universities, the goal of teaching reform is basically the same, that is, to achieve the effect of cultivating high-quality talents by improving the quality of course teaching. This paper takes university physics experimental teaching as an example, analyzes the problems existing in university physics experimental teaching, and combines the talent cultivation objectives of local colleges and universities and informatization teaching needs, puts forward the "school-based characteristics" mixed teaching mode, and carries out the corresponding research. The study shows that the mixed teaching mode based on "school-based characteristics" enhances students' sense of independent learning and effectively improves the quality of teaching and talent cultivation.

Keywords: Information Education, School-based Characteristics, Mixed Teaching Mode, University Physics Experiment

1 Introduction

With the rapid development of information technology, the application of technologies such as the Internet, big data and artificial intelligence has become very widespread, promoting the application of high and new technologies in all aspects of human society and having a significant impact on people's lives. Human society has entered the age of information technology, but people's understanding, mastery and application of information technology are still far from enough[1]. The impact of the development of information technology on the education system is also very great. Higher education institutions are important venues for training talents, and they should keep abreast of

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the times as a way to cope with the great changes brought about by information technology. The development of the times and the progress of science and technology have put forward new standards for the quality of talents, and the traditional teaching mode of higher education has been unable to adapt to the requirements of the development of the information age [2], and the work of educational and teaching reform in higher education is an important initiative to improve the quality of talent training [3]. In April 2018, the Ministry of Education issued the Action Plan of Education Informatization 2.0, which emphasized the revolutionary impact of informatization technology on education. In February 2019, the printing of the CPC central committee and the State Council of China education modernization 2035 also pointed out the need to vigorously promote education informatization. Therefore, the reform of teaching and learning relying on informatization education has become an important part of the future construction of institutions of higher education. Higher education institutions should adhere to the core concept of the deep integration of information technology and education and teaching, think about the change of the teaching mode and innovative development strategies, so that it can be widely applied to the construction of the curriculum to further improve the quality of talent cultivation, in order to meet the needs of the development of human resources in various fields of society in the era of information technology.

2 The Development of Information Technology Poses New Challenges to Education and Teaching in Higher Education Institutions

2.1 Teachers' Teaching Ability Faces Challenges

With the rapid development of modern information technology and the Internet, the channels for college students to acquire knowledge have increased, and with the increase of platforms and carriers for acquiring knowledge, classroom teaching in higher education is no longer the only way for college students to acquire specialized knowledge. The traditional lecture-type teaching mode of higher education has been unable to meet the needs of the development of teaching, the future of education and teaching requires college teachers to have a higher level of modern educational thinking and information skills. In addition, what kind of methods should be adopted by college students for learning in the current context is also an important issue for college teachers to think about.

2.2 Students' Learning Styles are Facing Challenges

Along with the development of network and science and technology, the thinking of college students as well as the learning environment has changed dramatically, especially the common use of smart phones, tablet computers and other mobile electronic devices, which put forward new requirements for the content and methods of classroom teaching in institutions of higher learning. If the content of classroom teaching is not

rich or students' self-discipline is not strong, students are very likely to be distracted, play with cell phones and doze off during classroom teaching. In order to overcome these problems, there is an urgent need for higher education teaching and learning models to be adapted to the impact of changes in the student learning environment.

3 The Importance of Exploring the Experimental Teaching Mode of University Physics Based on the Background of Informatization Education

In 2018, the Opinions of the Ministry of Education on Accelerating the Construction of High-Level Undergraduate Education and Comprehensively Improving Talent Cultivation Capabilities (JG [2018] No. 2) pointed out that it is necessary to "vigorously promote the application of modern technologies such as the Internet, big data, artificial intelligence, virtual reality and other modern technologies in teaching and management, and to explore the implementation of networked, digitized, intelligent and personalized education. Strengthen the construction of on-campus experimental teaching resources, and build an experimental teaching platform with intensive functions, resource sharing, full openness and efficient operation." Further improvement of practical teaching reform in higher education under the background of informatization education is necessary for the development of national education and teaching, and it is an important means to practically improve students' innovative spirit and practical ability, so exploring the new teaching mode of practical courses in higher education under the background of informatization is the trend of the development of teaching reform. Physics is the foundation of the entire natural sciences, and the fundamental laws it studies are of great generality and are the basis of other natural sciences and modern engineering technology. Physics experiments are an important support for these theoretical studies, and an important factor in promoting the development of science and technology and engineering practice. For the freshmen of science and technology in higher education, university physics experiment is a very important public foundation course in higher education, and it is also the earliest experimental science that college students can contact with systematically and operationally, and this course has an important role in cultivating students' practical ability, innovative thinking and scientific literacy. Therefore, it is of great significance for this paper to take the university physics experiment course as an example to carry out the investigation of teaching mode based on informatization background, which is also useful for some practical courses in other disciplines.

4 Problems in the Traditional Teaching of University Physics Experiment Courses

4.1 Experimental Sites are Restricted and Have Limitations

Traditional university physics experimental teaching can only be carried out in the laboratory, subject to the limitations of the laboratory area, generally can only be taught in small classes, if encountered power outages, laboratory emergencies can not enter the laboratory class, can only be postponed to the experimental date or stop the class, which seriously affects the teaching progress and the learning effect of the students.

4.2 The Number of Models and Sets of Experimental Instruments is Limited, and Most of the Experiments are Basic Validation Experiments

Physics is a theory and experiment closely linked to the discipline, in order to deeply understand the theoretical content of the teaching, experimental courses in the experimental program to open the majority of validation projects, so the model of the experimental equipment is relatively single, generally the same type of experimental equipment 10-20 sets of practical operation for students, can only satisfy the syllabus in the opening of the basic experimental projects, comprehensive, design experimental project resources are insufficient, and only for small class teaching needs. It can only meet the basic experimental programs in the syllabus, and the resources for comprehensive and design experimental programs are insufficient.

4.3 The Teaching Mode is Single, and the Teaching Content is Seriously Out of Touch with the Development of Science and Technology

In the classroom teaching of university physics experiment courses, relatively more traditional teaching methods are maintained, i.e., the teacher lectures all the experimental principles, operation steps and other contents, and the students passively receive them before starting to do the experiments. Teaching methods are relatively single, students lack the motivation of active learning, the course content is limited by the experimental apparatus, and the experimental program is outdated. At present, the development of science and technology is changing rapidly, modern society has entered the era of informationization and intelligence, college students should master the knowledge of cutting-edge development of science and technology, but also should expand their horizons and have high-quality practical application ability.

4.4 Teacher-student Interaction is Ineffective, and Course Resources are Insufficient to Scientifically Assess Student Learning

The teaching effect of the course is good or bad, and the teaching interaction between teachers and students has a great relationship, relying solely on classroom teaching interaction teachers can not accurately grasp the learning situation of students, the need

to increase other aspects of teaching interaction. In addition, most of the students in the teaching class can complete the experimental content in the prescribed time, the teacher's assessment of the students' lack of personalized, targeted, statistically accurate platform, resulting in most of the students' results are similar, the lack of scientific and reasonable assessment and evaluation standards.

5 University Physics Experiment Teaching Solutions

5.1 Changing Teachers' Thinking and Forming a Curriculum Teaching Reform Team

Front-line teachers are the implementers of the curriculum teaching reform, and must focus on the transformation of teachers' teaching ideas, so that teachers are fully aware of the great impact of the reform and innovation concept and the development of information technology in the new era on teaching. Teachers should have the ability to use modern information technology tools to achieve effective integration of information technology and laboratory teaching, and think more about how to use modern information technology to explain the new ways of knowledge to enhance students' understanding of knowledge. The teaching reform work of a course needs to start from many aspects, such as planning the overall teaching system of the course, modifying the course syllabus, the construction of course resources, etc., which is not a one-step process, but a cyclical and gradual process, so it is necessary to set up a teaching reform team for the experimental course of university physics. The teaching reform team should preferably consist of 5-7 young and middle-aged teachers who are characterized by rich front-line teaching experience, strong learning ability, courageous teaching innovation, and some experience in teaching reform. Teachers should think hard, have the mission of teaching and educating people, pay more attention to the correlation between education and scientific and technological development, keep the right and innovative forms of education and teaching, and constantly learn and make progress in order to ensure that the development of education and teaching to meet the needs of the times.

5.2 Investigating and Researching to Provide a Research Basis for Constructing the Experimental Teaching Mode of University Physics Under the Background of Informationization Education

Investigation and research is the necessary pre-conditions to carry out teaching reform, the teachers of the curriculum teaching reform team can use a variety of methods to carry out investigations, access to information, questionnaires, seminars and discussions, field surveys, and through the investigation and research on the domestic and foreign relevant teaching resources have been collected and organized, and from which to learn from the experience, in order to build the information technology education under the background of the experimental teaching mode of university physics to provide the design of ideas and a rich database of resources for the curriculum.

5.3 Adding Elements of Curriculum Ideology and Politics, Utilizing the Characteristics of the Discipline to Stimulate Students' Interest in Learning and Their Sense of Independent Learning

In 2020, the Ministry of Education issued the Guideline for the Construction of Higher School Curriculum Civics and Politics (JG [2020] No. 3), which puts forward that "combining the characteristics of different courses, methods of thinking and value concepts, the elements of curriculum civics and politics should be excavated in depth and organically integrated into the teaching of the courses, so as to achieve the effect of educating people in a silent way." It shows that while cultivating students' ability, we should not neglect the education of college students' ideological quality, so it is a very important work to add the elements of course ideology and politics in university physics experiment course. University physics experiment course has a natural element of ideology and politics, the spirit of excellent physicists in scientific research can greatly infect the students' thinking, to help students set up a high standard of the spiritual world, with the spirit of the pillar, learning will have the power. The development of information technology has accelerated the construction of the university physics experiment course of the ideological and political work, stimulate the students' interest in learning, is conducive to the formation of independent learning, independent investigation ability, with the truth-seeking and pragmatic, scientifically rigorous experimental literacy.

6 Mixed Teaching Mode of University Physics Experiment Course Based on "School-based Characteristics"

In recent years, the educational technology in higher education has developed rapidly under the influence of the background of informatization education, which promotes the development of educational and teaching reforms in various disciplines in higher education, and the use of computer networks, big data, artificial intelligence and other modern means of information for teaching has become a major trend in the future development of teaching disciplines. So how to use these modern information means to make university physics experiment teaching to the development of high-quality teaching is also the focus of higher education research and difficult content. There are a lot of teaching researches on university physics experiment courses in Chinese colleges and universities by using the Internet and information technology means, and certain research results have been achieved [4-8], these researches have a certain reference to the teaching of higher education institutions, but the teaching effect is not very satisfactory when applied in practice. The reason for the analysis is that there are great differences between different institutions of higher education in terms of school orientation, talent training, etc. Therefore, institutions of higher education should customize the mixed teaching mode in accordance with their own school characteristics in line with the "school-based characteristics" of the curriculum system. In this paper, based on the problems existing in the traditional experimental teaching, combined with the talent cultivation objectives and teaching needs of local institutions, relying on

information technology for curriculum construction, from point to point, gradually carry out teaching reforms on the curriculum, forming a "school-based characteristics" online and offline mixed teaching mode, so as to effectively adapt to the requirements of talent cultivation of the information society for higher education.

6.1 Construction of Online Resources for University Physics Experiment Teaching Based on "School-based Characteristics "

Although the university physics experiment course is a public basic course for science and engineering majors, the university physics experiment projects offered by different higher education institutions are not exactly the same, or students complete the same name of the experimental project but use different models of experimental instruments and equipment. There are a lot of university physics experimental teaching resources on various high-quality online course teaching platforms, but the matching degree between the experimental teaching instruments used in classroom teaching in different institutions of higher education and the online platforms is not very high, so it is necessary for teachers of the university to combine with the actual conditions of the school to build online teaching resources with "school-based characteristics".

In the first step, after the formation of the curriculum teaching reform team, the person in charge will formulate the specific content and implementation plan for the construction of online resources with "school-based characteristics" on the basis of the preliminary research report. Figure 1 shows the basic content of the "school-based" online resources.

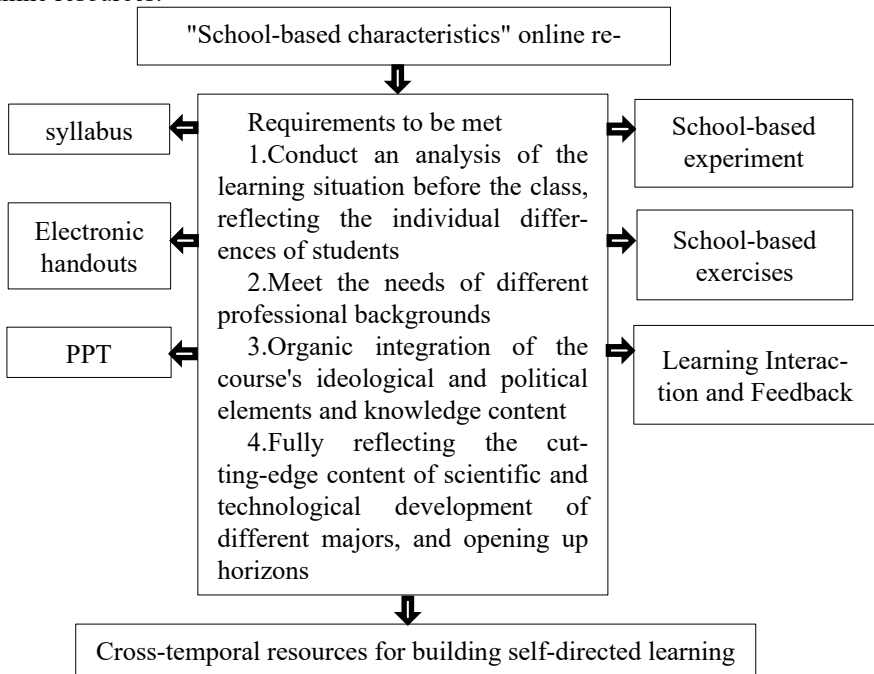


Fig. 1. Basic content of "School-based characteristics" online resources

The second step is to lay out the division of tasks among the faculty members of the course instructional reform team. Teachers in the implementation of this task should fully consider the characteristics of the students' learning situation in their colleges and universities, in the design of the syllabus, electronic handouts, PPT, experimental videos and exercises, should be combined with the difficulty of the chapters of this course, the objectives of talent cultivation, the integration of the course of ideology and politics, the assessment and evaluation standards and other comprehensive factors, to design a more scientific and complete school-based characteristics, suitable for students of various majors in science and technology learning Experimental online teaching resources, so that online experimental teaching resources are highly consistent with the orientation of talent training in universities.

In the third step, an online teaching platform is used to upload school-based online resources, such as the Wisdom Tree platform (website: www.zhihuishu.com) as the main carrier of online teaching resources, uploading the content of online resources classified to the Wisdom Tree platform, and making full use of the platform's functions to give full play to the inter-temporal and fragmented learning functions of online teaching resources.

6.2 Based on Online Virtual Simulation Experiment Platform to Assist Students' Experimental Operation

The construction of online resources with "school-based characteristics" has provided students with sufficient learning resources in the early stage, but there is still a gap in the cultivation of students' practical operation ability in the experiment, and they need to establish the basic operation foundation before carrying out the experiment offline, so the integration of on-campus online resources with the virtual simulation experimental program of university physics can better play the role of teaching and learning in the early stage. The virtual simulation experimental platform can not only complete the basic experimental projects, but also simulate the complex experimental projects that can not be completed in the laboratory, which can expand the knowledge system of students. Through the virtual environment of the experimental operation practice, can be in the pre-study, online simulation and other modules to obtain assessment scores, for students to carry out offline experiments when the teacher assessment evaluation to provide accurate data reference.

6.3 Offline Resource Construction of University Physics Experiment Teaching Based on "School-based Characteristics"

Pilot Class Teaching Comparison Construction

University physics experiment courses for a wide range of specialties and a large number of students, according to the division of labor in the teaching reform team, you can arrange for a fixed teacher for each specialty, and then according to the teacher's configuration, select a portion of the specialty first to carry out the practice of blended mode of teaching, break the traditional form of classroom teaching, make full use of information technology means and online resources to carry out teaching, enrich the

classroom content, stimulate the students' interest in learning, and encourage the students to participate in various forms of teaching interaction, so that passive learning becomes active participation. Students participate in various forms of teaching and learning interaction, so that passive learning becomes active participation, and realize quality teaching in the classroom. After a period of teaching practice, the learning performance of the pilot teaching class and the traditional teaching class will be evaluated comprehensively, and when the implementation feedback is good, it will be further extended to all majors.

Capacity Building

With the development of information technology, more and more scientific software reflects the advantages of computing power, which we can fully appreciate in all aspects of life. University physics experiments will produce a large amount of experimental data, experimental data processing and analytical ability is also a very important part of experimental teaching, traditional teaching students manual calculation method takes a long time, and the accuracy is not very high, the teacher can guide the students combined with scientific software for experimental data processing, not only can greatly improve the efficiency of the experimental data processing and the accuracy of the data, but also can enhance students' interest in learning, the ability to think independently, build self-confidence, and have a good auxiliary role in cultivating students' later computing ability and the spirit of inquiry. At present, there are many software that can process experimental data. Excel, Origin and Matlab are common software, and other software can also be used. For example, Igor Pro software and smart phones can be used to observe the data processing process of Newton ring interference experiment[9], and Mathematica software can also be used to process the data of Newton ring interference experiment[10]. The development of information technology makes the development of scientific software is also very fast, teachers can choose the appropriate software to assist teaching, not only to deepen the students' understanding of the experiment itself, but also through the classroom guidance to improve the ability of data processing, and cultivate the scientific literacy of students.

6.4 Problems to be Solved by the Mixed Teaching Model of University Physics Experiment with "School-based Characteristics"

The construction of online resources to solve the problem of insufficient space and limited space in the traditional laboratory; to solve the problem of the mismatch between the resources of multiple high-quality teaching platforms and the existing experimental projects in the laboratory; the use of big data can realize the statistics of the learning situation of the online resources, to solve the problem of the inability to accurately count the pre-course learning to carry out the assessment and evaluation; to solve the problem of the video re-watching work in case of doing experiments offline is unsatisfactory; to solve the problem of limited time for the practice of experimental operations. The introduction of the elements of ideology and politics in the university physics experiment course can solve the problem of students' ideological confusion and

fear in learning, and can provide spiritual guidance to students, establish a positive scientific spirit and facilitate the formation of an independent learning consciousness. The construction of offline resources, the pilot classroom teaching fully embodies the role of information technology education in classroom teaching, teachers can use the construction of online resources to re-teaching design, innovative forms of classroom teaching, can effectively use mobile electronic devices and students interact with each other, not only to effectively reduce the use of these devices in class to access the Internet, play games to distract the attention of the study, but also to stimulate the students' Interest in learning, really bring students into the classroom, participate in the whole process of teaching. In addition to exercising the students' thinking ability and practical operation ability, the teachers' guidance on the students' experimental data processing by utilizing the scientific software enhances the students' computational ability.

According to the orientation of our university and the characteristics of students, the reform of university physics experiment teaching based on the "school-based characteristics" has improved the educating ability of the curriculum and closely integrated information technology and experiment teaching. The effect of differentiated teaching is well reflected in the process assessment of students, and it is difficult to accurately reflect the differences in the process assessment of students in traditional teaching classes. The evaluation of the process assessment of the pilot teaching class with "school-based characteristics" is more scientific and accurate than that of the traditional teaching class. Student course grades in the pilot teaching class improved significantly over course grades in the traditional teaching class. Examples of course grade comparisons between the pilot and traditional teaching classes are shown in Table 1.

Table 1. Comparison of course grades

| Classes (partial) | Class size | Numberof persons (>90 points) | Percentage of course grades (>90 points) | Class average score |
|------------------------------|------------|-------------------------------|--|---------------------|
| Pilot teaching classes | 26 | 9 | 34.62% | 88.6 |
| Traditional teaching classes | 28 | 3 | 10.71% | 78.2 |

7 Conclusion

Currently, under the influence of the background of information technology education, higher education is constantly reforming and innovating the form of teaching, which promotes the integration of practical teaching and information technology, and higher education institutions need to constantly update and explore the content of education and teaching and teaching mode. This paper takes university physics experiment course as an example, constructs a new teaching mode, carries out the research of mixed teaching mode based on "school-based characteristics", solves the problem of teaching effect variability produced by different universities due to a se-

ries of conditions such as school orientation, students' characteristics, teaching staff, hardware conditions, and so on, and incorporates the elements of course ideology and politics into the course, improves the nurturing ability of the course, facilitates the students to form the awareness of independent learning and scientific literacy, and effectively improves the quality of the course teaching quality and the quality of talent cultivation.

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