Research on Informatization of Classroom Teaching Based on Learning Data Analysis

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Abstract. In order to improve the learning quality of newly-built application-oriented college students, a three-level classroom teaching improvement model based on learning data analysis is proposed. Three levels are data collection, behavior analysis, and teaching applications.142 students from the engineering college of a newly-built newly-built application-oriented university by means of network survey tool were investigated. The results show that the importance of the course is directly related to the learning difficulty. Meanwhile, the more important the course is, the greater the learning difficulty is. Students have different difficulties when learning courses and more than 70% of students think they cannot use the knowledge they have learned to solve practical problems. More than 75% of the students believe that there are effective measures to improve curriculum teaching, such as using modern technology to assist teaching, innovating teaching devices, and reforming teaching methods to stimulate students' activity. On the basis of investigation and analysis, some advices about teaching reform are put forward.

Keywords: Engineering education · Newly-built application-oriented university · Teaching improvement model · Data collection · Behavior analysis · Teaching applications

1 Introduction

Application-oriented undergraduate course is positioned to cultivate applied technology talents. Based on the needs of local talents, most application-oriented undergraduate universities, aiming at cultivating high-quality application-oriented talents, actively give full play to their own talents and technological advantages, as well as serve and promote regional economic development [9]. Due to the short history and insufficient experience, the newly-built applied undergraduate universities have urgent problems in the goal orientation, school philosophy and discipline construction. In addition, the quality of their student training is also unknown. To better promote the newly-built undergraduate universities to become an important force in reform of Chinese higher education and

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play an important influence in economic construction like well-known universities in China, it is indispensable to consider the training of application-oriented, technical and innovative high-quality talents as the first goal [10]. It is necessary to keep pace with the times and carry out teaching reform in accordance with local conditions on the basis of full understanding of school running and students' learning situation [1], so as to continuously improve the quality of talent training.

In recent years, in order to improve the quality of classroom teaching efficiently, Chinese colleges and universities are reforming the traditional mode of talent training [2]. Shantou University, as the first one to carry out CDIO engineering education Reform in China [5], has carried out in-depth research and practice on the CDIO. Gu Xueyong of Tsinghua University, who adopted CDIO method in two courses, namely "Data Structure" and "Database Technology" has achieved good results. Jiangxi University of Technology launched the "3 + 1" innovative education model based on the CDIO concept, and its concept of "treating students as the most important asset of the University" was highly recognized. The University of Calgary has carried out cooperation projects such as "Global Leaders and Innovation learning" and "CDIO Exchange" for more than 10 years, which actively promoted the reform of engineering education. The University of Vietnam, explored the advantages of the CDIO as a basic improving solution, has effectively improved the teaching quality of intercultural communication courses [7]. On account of the Problem-based learning, Vishwaniketan I meet of Engineering has designed different PBL models for different learning objectives, and built a unique teaching system framework to support PBL practice. The University of British Columbia (UBC) widely uses the "TBL + Two-stage Exam mode" in large science classes, broken the long-term single assessment mode and greatly improved the teaching efficiency of large classes [8]. These successes of the above teaching reform are based on the in-depth understanding and investigation of students' learning status. However, since the actual conditions and students' learning abilities vary from country to country, the teaching reform of the newly-built application-oriented universities cannot copy the successful cases of other teaching reforms, but must be based on the actual conditions of the universities, carry out teaching reform suitable for oneself.

Based on the requirements of the new engineering education reform and the successful experience of the teaching reform [4] at home and abroad.

In order to improve the learning quality of newly-built application-oriented undergraduate students, a three-level classroom teaching improvement model based on learning data analysis is proposed in this paper. First, the learning difficulties of the undergraduate engineering students were investigated. Then, the learning behavior of the students were analysed. Finally, some suggestions for the improvement of teaching application were put forward.

2 Establishment of Classroom Teaching Improvement Model Based on Data Analysis

A three-level classroom teaching improvement model based on learning data analysis as shown in Fig. 1. According to the bottom-up sequence, the framework of this model includes three levels: data collection, behavior analysis and teaching application. The

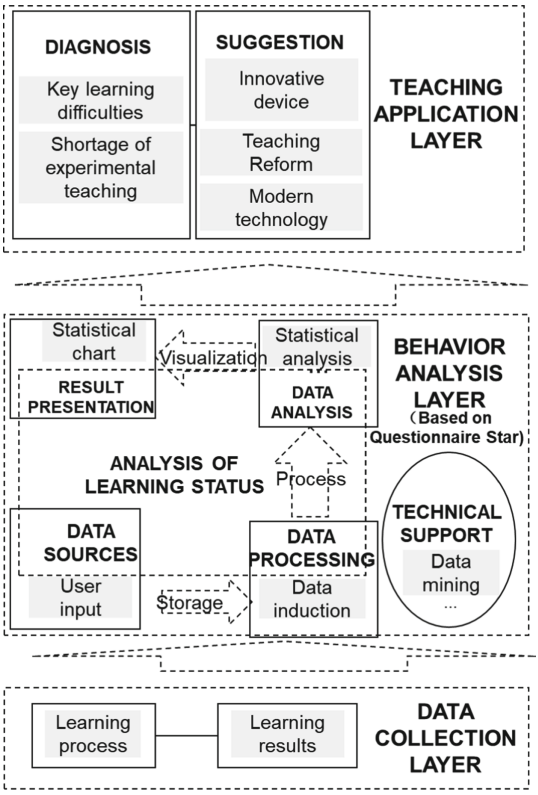

Fig. 1. Three-level teaching improvement model

three levels are interconnected and circularly optimized. As the basic support of classroom teaching optimization, data collection layer is the main basis for analyzing the current classroom teaching situation and students' learning state. As the central level of the framework, behavior analysis layer takes learning analysis as the core to process, analyze and present the collected data. On the basis of data analysis, the teaching application layer puts forward constructive suggestions through precise positioning and interactive intervention.

3 Data Collection

The objects of this study are the students of the Construction Institute, a new application-oriented undergraduate university in Zhejiang Province of China. The Questionnaire named Learning Status of Engineering Students is designed, which consists of 12 questions, including 5 single-choice questions and 7 multiple-choice questions. The 12 questions focus on three aspects, which are key learning difficulties, current situation of experimental teaching, as well as problem diagnosis. The questionnaire is carried out with the help of "Questionnaire Star", a total of 142 questionnaires are issued, and 142 are effectively recovered, with an efficiency of 100%.

4 Behavior Analysis

142 questionnaires are distributed in this survey. Among them, 36.29% of the respondents are civil engineering majors, 33.87% are engineering management majors, 29.03% are engineering cost professionals, and the rest are other majors. The survey is carried out for engineering students, and the results are analysed as follows.

4.1 Key Learning Difficulties

Students generally attach importance to the study of professional courses. It is found from Fig. 2 that 48.80% of students consider major courses as the most important courses in universities and only 8.00% of students consider public courses are the most important. It is the consensus of most students that professional courses are more important, and students generally attach importance to the study of relevant professional knowledge.

The three most important courses are Basic Principles of Concrete Structure, Building Architecture and Basic Principles of Steel Structure, which are selected by 84.80%, 36.80% and 34.40% of the students respectively. In addition, 33.40% of the students think Architectural Structure is also very important.

Students generally believe that Basic Principles of Concrete Structure is the most difficult subject, followed by Building Structure, selected by 84.80% and 34.40% of the students respectively. 33.60% think it is difficult to learn Building Architecture and Basic Principles of Steel Structure. The analysis is found that the serious "difficult courses" in the eyes of students have a high degree of repetition with the most important courses, resulting in the phenomenon of "important but difficult".

It can be seen from Fig. 3 that students have a low grasp of the difficult courses. It is found that only 8.80% of the students fully master the course content. Meanwhile, as high as 73.60% of the students feel that they have only mastered part, and there are still many puzzles that are difficult to understand and solve in the learning process. In addition, 17.60% of the students think that they have no knowledge of difficult courses.

It can be seen from Fig. 4 that students have different causes in learning difficult courses. It is found that 72.80% of students think that they are inflexible in mastering knowledge and could not use what they have learned to solve practical problems. 61.60% of the students think that the course contents are too much and the theoretical formulas are too obscure to be understood. 52.80% of students do not experience the sense of

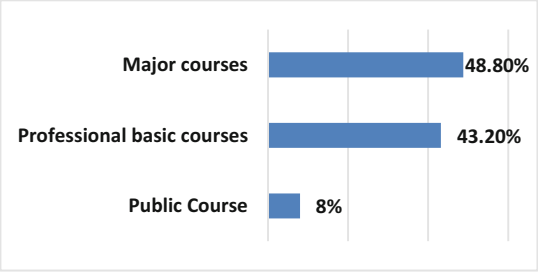

Fig. 2. Important course in the eyes of the students

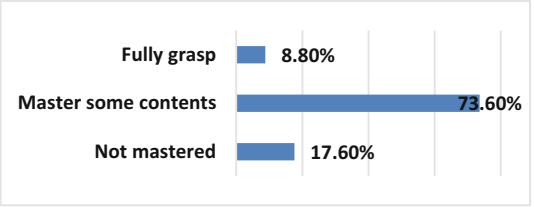

Fig. 3. Students' mastery of difficult courses

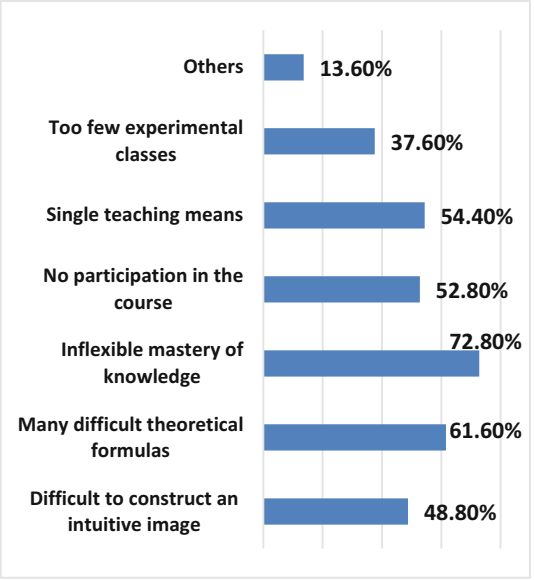

Fig. 4. Students' difficulties in learning difficult courses

participation in class, making it difficult to actively master knowledge. 54.40% of the students think that the means of classroom teaching is boring, only focusing on classroom teaching, lacking the extension of diversified extracurricular knowledge. In addition, 48.80% of the students consider it difficult to build an intuitive image of theoretical knowledge, and 37.60% of the students think that the experimental hours are too few to build a bridge between phenomenon and theory.

4.2 Current Situation of Experimental Teaching

The place of experimental teaching is relatively fixed. The survey is found that 85.48% of the experimental courses are taught in the classroom and only 9.68% in the laboratory. 60.48% of students think that the forms and methods of laboratory teaching and the experiment aremonotonous and boring. 58.06% of the students think that the teaching mode gives the impression that the experiment is not related to the theory. 57.26% of students point out that the experiment locations are varied and it is inconvenient to go

to different laboratories. 55.65% of the students believe that the equipmentis insufficient which causes the lack of hands-on experience. 45.16% of the students thought that the distance is far from the experimental instrument, influencing the learning effect of the whole experimental process. Shown by the questionnaire data, how to balance the contradiction between supply and demand under the condition of insufficient hardware facilities such as poor experimental equipment, and how to maintain good observation and learning effect under the distance from the experimental instruments are the directions of experimental curriculum teaching needs to be improved.

4.3 Demand and Problem Diagnosis

Students' suggestions on solving the course learning difficulties reflect the students' needs in the course learning. In order to solve the students' learning difficulties, the questionnaire proposes targeted solution measures, in which dividing the knowledge module to determine the course focus is supported by 64.52% of the students. Besides, 59.68% of students support the use of modern technology to make knowledge learning and experimental observation more detailed. 54.84% of students think classroom interaction should be increased. 52.42% of students believe that innovative experimental devices should be used, making the experimental operation more convenient and easy to understand. 51.61% of the students support the division of knowledge modules and the determination of the key points of the courses. 47.58% of students believe that multi-dimensional and multi-form display of course content can improve students' interest in learning. 44.35% of students think that theory can be combined with practice, hoping that the teacher can demonstrate the experiment while talking about the theory. 3.06% of the students support the understanding of the essence through the phenomenon, and hope to make the students realize the mechanism and principle behind the phenomenon through the experimental demonstration. Most of the targeted solutions given in the questionnaire are approved by the students.

Students are highly receptive to the three measures to solve their teaching difficulties, as shown in Fig. 5. 83.87% of the students believe that the difficulties in curriculum teaching can be solved by using modern new technology to assist teaching. 79.84% of students support innovative teaching devices, so that students can see the phenomenon behind the theory and formula in class. 75% of students said it is also important to improve student participation, and that teaching methods should be reformed to stimulate classroom activity. Additionally, it is noteworthy that the intelligent laboratory based on real-time projection technology, VR and other modern media technology [6] has been put into use in many high-level universities.

5 Teaching Application

5.1 Make Full Use of Modern New Media Technology to Assist the Whole Process of Classroom Teaching

Under the background of the new engineering construction reform and the intelligent era oriented with the Internet, the key to deepen the reform of higher engineering education

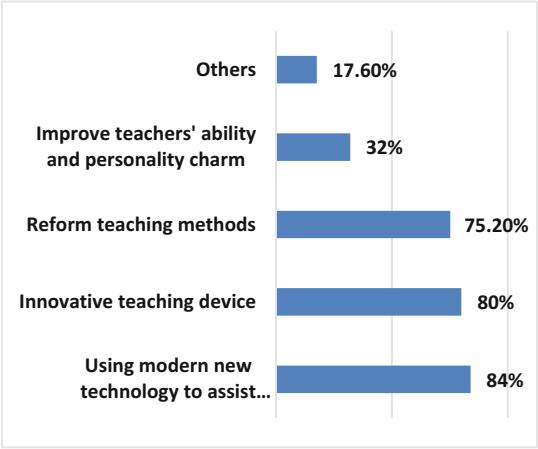

Fig. 5. Means to solve difficulties in course teaching

is to explore the integration of the modern media technology and the new engineering education. It is necessary to realize that modern new media technology not only is a hardware educational facility such as educational APP and electronic whiteboard, but also can introduce technologies such as virtual simulation and VR into engineering teaching, building such as multi-screen interaction, immersion experience and other forms of "Wisdom space", and combining multiple teaching methods to create a "Wisdom classroom" new teaching model. Through visual way or immersive experience, it can help students master the basic knowledge, stimulate their interest in learning, arouse their initiative in learning, and improve their ability of comprehensive application. Additionally, in the post epidemic era, smart classroom bears the important task of online and offline hybrid teaching, and its necessity and effectiveness are becoming more and more prominent.During their study at home, students can conduct online teaching in the form of live broadcasting, on-demand and other new media technology platforms.

5.2 Innovate Teaching Devices and Apply Them to the Classroom to Help Students See the Phenomenon Behind the Theories and Formulas

Traditional education mainly focuses on theoretical teaching, and experimental teaching is the demonstration and supplementary link of theoretical teaching. In the process of experimental teaching, students often complete the experimental operation mechanically within the set range of the experimental content, operation methods and procedures, report format, and even the results of each step. Teachers can innovate the teaching device, make the large-sized laboratory device convenient through the scientific principle innovation, and make the device out of the "Laboratory", into the "Classroom", breaking the limitation of classroom space. At the same time, teachers and students can get out of the predicament of lacking facilities and resources, and away from the mechanized experimental teaching. As long as students are willing, they can practice in class, feel and better understand the charm of obscure semi-theoretical knowledge. Teaching device with innovation also can arouse students' interest in learning to a certain extent.

Through comparing with the old and new devices as well as analyzing the principles, it could improve the students' thinking, practical, innovation ability to solve engineering problems, which is in line with the proposed training objectives of innovative and independent talents.

5.3 Reform the Teaching Modes and Methods to Effectively Improve Students' Participation in the Classroom

Students are the object of teaching, and students' mastery of knowledge and skills is an important symbol of teaching success [3].Engineering professional courses often involve a lot of semi-empirical and semi-theoretical knowledge which is boring and difficult to understand, and the nature of the course has a strong logic and operability. Therefore, teachers can not only hear student needs, but also focus on the reform innovation of curriculum and teaching mode. For example, for civil engineering students, "green building", "prefabricated building" and "sustainable development" can be added to expand students' international vision. Short videos of architecture shows with design significance and practical value can also be played to attract students' interest. Meanwhile, teachers should play the role of learning guides, cooperative learners and consultants, responsible for summarizing comments and guiding key issues. Teachers can actively try heuristic, autonomous, discussion, research-based teaching methods, so that students become the main body of the teaching process.

6 Conclusions

(1) It is the consensus of most students that professional courses are more important. Students have different difficulties in learning courses, but the importance of the course is directly related to the difficulty. The more important the course is, the more difficult it is.
(2) According to the behavioral analysis effective measures for improving curriculum teaching are mainly using modern technology to assist teaching, innovating teaching devices and reforming teaching methods to stimulate students' classroom activity.
(3) As a general framework, the three-level classroom teaching improvement model based on the analysis of learning data can not only provide teachers with ideas of teaching optimization, but also provide technicians with ideas of developing classroom information.

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