Education Reform of Theoretical Mechanics for Civil Engineering in Big Data Era

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Abstract. The "Theoretical Mechanics" course is a basic mechanics course for undergraduates majoring in civil engineering. Based on the teaching status of the course, it conforms to the development trend of the era of big data, analyses the necessity of teaching reform and gives corresponding countermeasures. Practice has shown that the teaching reform of the "Theoretical Mechanics" course in the era of big data has greatly increased the enthusiasm of students to learn the course and the quality of teaching Guarantee. It provides an effective guarantee for the cultivation of high-level, high-quality modern scientific and technological engineering talents in the era of big data.

Keywords: Big data; Theoretical mechanics; Teaching reform; Current situation.

1. Introduction
The development of science and technology and the popularization of the Internet have provided a good environment for the development of big data [1]. The data itself has no value, but if all the acquired information is analysed and applied by big data, it will generate unlimited value. The current society has a large demand for modern scientific and technological talents who can adapt to the development of the big data era, and urgently needs talents who have big data thinking and can use big data to analyse and deal with problems. In undergraduate education, courses are the main way to cultivate talents, so curriculum reform in the era of big data is very necessary, and theoretical mechanics courses are no exception.

Theoretical mechanics is a basic mechanics discipline. Studying this course can lay a solid foundation for the study of material mechanics, structural mechanics, and elastoplastic mechanics. At the same time, the rigor and strong logic of the course itself can also train students’ scientific literacy. So learning this theoretical mechanics course is the goal that every student must achieve. To a certain extent, the opportunity for the era of big data is not well grasped, so the teaching reform of the theoretical mechanics course in the era of big data is imperative.

2. Course Teaching Status and Existing Problems
The three main subjects of the teaching curriculum are the classroom, teachers and students. The classroom is the carrier of teaching activities. Teachers play a guiding role in the classroom [2]. The
students are the main body of the classroom. The three must cooperate with each other to give full play to their respective roles. Ensure the smooth implementation of teaching.

2.1. Problems in Course Teaching
The theoretical mechanics course has a total of 72 hours, 18 weeks, excluding the exam for 2 weeks, a total of 64 hours. Among them, the first three sections of each week are taught by teachers, and the fourth section is exercise classes. The theoretical mechanics course is more theoretical and the formula derivation process is cumbersome. All three lessons are taught by teachers, which makes students lose a lot of space for independent thinking, and there is not enough time to introduce the latest scientific research results and academic dynamics related to the course, and the allocation of class hours. Unreasonable. In addition, the teaching curriculum theory and practice are not closely connected [3]. Most of the contents in the textbooks are abstract and simplified schematic diagrams, which are more difficult and abstract for students without practical experience to understand, and they do not combine theory and practice very well.

2.2. Problems with Students
The theoretical mechanics courses are arranged in the first year of students' enrolment. Most students do not have enough reliable knowledge of advanced mathematics and college physics courses, and the foundation is not solid enough. They may gradually lose their interest in learning because of a simple mathematical formula. Every time when it comes to formula derivation, many students will lose patience and even become afraid. On the other hand, most students lack initiative and just listen to the teacher during the class time. The pre-preparation and post-practice feedback is not done properly. They are unfamiliar with knowledge and have insufficient understanding. Apply relevant knowledge to solve problems more difficult.

2.3. Problems with Teachers
In the teaching process, teachers have a single teaching mode, usually adopting the "PPT + blackboard writing" teaching method, filling the whole classroom, failing to realize the dominant position of students in the teaching link, resulting in students often passively accepting knowledge, failing to exert students' subjective initiative, and improving The goals of the students' engineering literacy do not match.

2.4. Problems in the Assessment Method
The assessment method of the course is the final exam and the usual scores account for 70% and 30% of the total score. The large proportion of final grades results in students not paying attention to the accumulation of usual knowledge. As they approach the final exams, it is more common to temporarily embrace Buddhism to cope with the final exams. At the same time, it is impossible to comprehensively reflect the students' real learning situation, and teachers cannot adjust their teaching methods in a timely manner according to the students' learning situation.

3. The Necessity of Teaching Reform in Theoretical Mechanics

3.1. The Need of College Teaching Reform in the Era of Big Data
The Ministry of Education's "Higher Education Quality and Teaching Reform Project" advocates deepening teaching reform and comprehensively improving the quality of higher education. It cooperates with the "Excellent Engineer Cultivation Education Program" [4] and has guiding significance for enhancing the core competitiveness of engineering talents. In the context of the era of big data, the teaching reform of "Theoretical Mechanics" is not only a need for curriculum reform, but also an inevitable demand for teaching reform in colleges and universities.
3.2. The Importance and Development Needs of the Curriculum Itself in the Era of Big Data

The course "Theoretical Mechanics" is one of the three major mechanics of civil engineering, and it is the basis for learning the follow-up courses. The importance of its status determines the necessity of reforming it. Improving teaching reform is also a need for the course's own development. Development promotes reform, and reform requires development. Only in this way can students improve their enthusiasm for learning, cultivate their comprehensive ability in all aspects, further promote the improvement of teachers' teaching ability, and improve the teaching quality of the curriculum.

4. Teaching Reform Measures of Theoretical Mechanics

4.1. Reasonably Allocate Class Hours, Combine Theory with Practice

The first three lessons of the previous week are taught by teachers, the fourth lesson is changed to the first two lessons for teachers, the third is to review discussion exercises, and the last one is for extracurricular development. After adjusting the time, the original three lectures were compressed into two. In this case, teachers need to follow the outline requirements, some content is elaborate, and some content can be passed along. The use of multimedia teaching makes full use of classroom time, and the feature of large amount of information just makes up for the compression of teachers' teaching time. For example, some complex graphics can be presented with multimedia, which not only reduces the time for hand-work drawing, but also makes the graphics presented to students more intuitive and easy to understand. The third lesson is reserved for students. Teachers need to properly guide students to review the content of the discussion, and can also give some typical examples related to the content of this lesson, let the students discuss and answer, review and consolidate the knowledge points, which also avoids the phenomenon that some students only understand and will not apply produce. With appropriate small practice, students participate in the process of learning, thinking independently, and applying the knowledge they have learned to solve problems, so that what they have learned is really their own internal understanding. Finally, make full use of the fourth class, combined with the era background of big data and the development status of the course field, show students some theoretical conferences and scientific frontiers of theoretical mechanics through media and other forms, and cultivate students' scientific research sense and ideas as soon as possible.

4.2. Teaching Students According to Their Aptitude, Focusing on the Whole Process of Learning

Before teaching, teachers can use big data to simply analyze the learning situation of each student, analyze the relevant reasons for the differences, and try to teach students according to their aptitude. Fully understand the basic level of students, master the advanced mathematics, college physics and other courses, and make necessary knowledge supplements according to the actual situation of students to improve the learning effect of subsequent courses. Aiming at the problem of fear for some students, teachers can carry out small exercises in the third class. Reasonably set the difficulty level of the exercise questions. During the exercise, the teacher can guide the students appropriately, let the students try to solve the problem by themselves, and the teacher can explain the questions in detail after the students complete independently. At the same time, he is good at using the charm of language and encouraging students. The most difficult problems are solved by people step by step to cultivate students' self-confidence.

In addition, various online courses and data platforms, such as MOOC derived in the era of big data provide students with a very convenient way to study outside of class. Teachers can select online courses and courseware materials that meet the teaching objectives of the course for students to preview before class. The results of student preview greatly improve the efficiency of listening to the class. At the same time, online exercises are arranged for students to consolidate and practice after class, and submit the work results to the teacher according to the specified time. It not only supervises students' consolidation exercises after class, but also complies with the talent training strategy in the era of big data.
4.3. Reasonable Choice of Teaching Methods to Improve Their Professional Quality

Teachers, as deceivers of evangelism and teaching, not only need to make adjustments in teaching methods, but also need to strive to improve their professional standards in terms of depth and breadth. On the one hand, it is necessary to strengthen the subject research of the theoretical courses of the major, summarize and summarize the teaching methods, and generate the teaching experience that is most suitable for the students of the major. On the other hand, teachers should draw on the background of the era of big data and extensively study the valuable resources that big data brings to the field of theoretical mechanics. Big data analysis is the foundation of artificial intelligence. Machine learning is the core of artificial intelligence. Its neural network algorithm has a wide range of applications in mechanics [5]. Aiming at a large number of nonlinear mechanical phenomena existing in practical engineering problems, using the nonlinear mapping ability of the neural network can obtain a more accurate solution in the structural optimization problem than the general method. In addition, big data analysis is also a technology to study uncertainty. In traditional mechanics, we usually study continuous or small data analysis, and obtain accurate results. When there is enough data, a comprehensive and multi-dimensional analysis of the data may reveal the laws that have not been discovered before, and promote the development and reform of the discipline. At the same time, teachers can better impart their learning and understanding to students, so that students can better understand the opportunities and challenges brought by the era of big data, so as to enhance their ability and truly become a technology in the era of big data Talent.

4.4. Diversified Assessment Methods

Assessment is the ultimate means of evaluating teaching quality. A reasonable and effective assessment method is necessary to get as close to the actual teaching quality feedback as possible. In order to be able to discover problems in teaching and students' learning dynamics in time, the proportion of final exam results was reduced from 70% to 60%, and the proportion of usual scores was increased from 30% to 40%. 40% of the usual grades are divided into attendance, answering questions, completing online and offline assignments, and course essays. Increasing the proportion of usual grades makes students pay more attention to the learning and accumulation in the classroom at ordinary times, rather than approaching the end of the Buddha, even if they do not usually study at the end of the period, they can get a good score. The attendance rate can reflect the students' enthusiasm in class, answering questions and completing online and offline assignments can reflect students' learning status in real time. Course essays are a new way of extracurricular learning. Students can choose materials freely, they can learn the experience of this course, or they can analyze a certain formula and phenomenon in theoretical mechanics. The diversification of assessment methods can largely reflect the students' various qualities in a more comprehensive way, and it also trains students to pay attention to the results and the process of learning.

5. Summary

Combined with the problems existing in the teaching process of "Theoretical Mechanics" for civil engineering undergraduates in the era of big data, the necessity of teaching reform was analyzed. Integrate the technology platform and ideas in the era of big data into the teaching process, reasonably allocate class hours, combine theory with practice, fully understand each student, strive to improve their professional level, and adopt a variety of assessment methods. Such a reform method is in practical teaching Very good results have been achieved. But we cannot stop here. In the future teaching process, we must base on the background of the era of big data, effectively integrate the dynamics of students and the needs of curriculum development, and constantly reform and improve in order to deliver more high-quality and high-level for the country and society Modern technology talents.

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