Teaching Practice of Warp and Weft Network System of Mechanics Knowledge Using Superstar Learning Platform

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Abstract: The basic mechanics knowledge are scattered in the the professional courses in civil engineering from high point of view. This paper introduces an attempt based on Superstar learning platform ,aiming to build a systematic integrated knowledge network with mechanical principle and professional knowledge , the style of warp and weft relying on the organic combination of the core engineering case. It will help students form an overall looking on the major .Under the guidance of the concept of large-scale engineering, with the help of mind mapping and relying on the rich books and information resources of the platform, the fragmented knowledge is integrated through effective design before, during and after class in the course. Through a variety of activities and the big data statistics, the learning status of students can be effectively tracked and the more efficient and vivid interaction within classroom can be carried out . The abilities and skills required to solve complex civil engineering problems can be shaped .

Keywords: network knowledge of mechanics, Warp and Weft, Superstar learning platform, teaching practice

1 Introduction

"The transformation of some local undergraduate colleges into universities of applied technology" is another major orientation of engineering education after the "Excellent Engineer" program. How to adapt theory teaching to the needs of application-oriented talents training is one of the problems in the transformation of colleges and universities. Foreign engineering education lays emphasis on practicality. In the German FH model [1], theoretical teaching emphasizes application orientation and the application of scientific knowledge to practical production. MIT and other universities put forward the concept of CDIO engineering education [2], [3], emphasizing that students should learn engineering in an active, practical and organic way. The "Erlin Triangle" [4] curriculum structure of Erlin College of Technology combines engineering knowledge with business management knowledge and humanities and social disciplines, and has implemented successful experiments. As far as theoretical teaching is concerned, its common point is to emphasize the clear direction that theoretical teaching should aimed to the cultivation of students' engineering ability.

Mechanics knowledge permeates a series of civil engineering courses. However, there is a common phenomenon of separation between mechanicas and specialty courses in teaching, which greatly affects the function of mechanics in cultivating students' engineering ability.

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Students are not very clear about the role of mastering the mechanics principles, resulting in unclear direction and insufficient motivation. While in the study of professional courses, the knowledge of mechanics is diluted and forgotten, and the mechanical basis for further analysis, judgment and decision of engineering is insufficient.

Taking the design of bull leg column in the course "Principles of Concrete Structure Design" as an example, some students only remember to copy the complex normative provisions and formulas, ignoring the integration of knowledge. In fact, the design involves many knowledge points such as the balance of space force system in Theoretical Mechanics, the combined deformation in Material Mechanics, and the calculation of internal force in Structural mechanics. If students can be guided to discover the beauty of mechanics on the basis of students' active mechanical analysis and modeling, the basic concepts on the nodes of the working conditions in civil engineering will eventually form a three-dimensional knowledge system of warp and weft applications. (See Figure 1 for ideas).

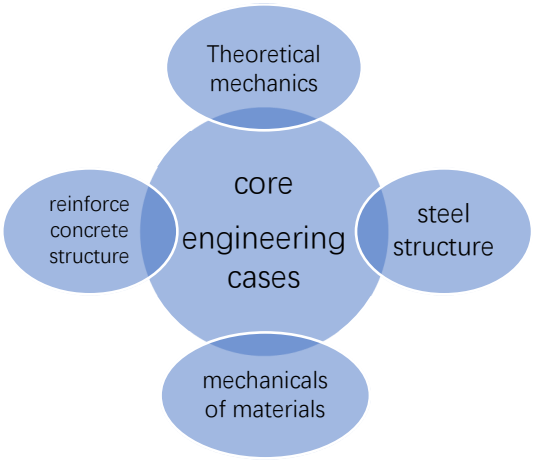

Fig 1. Frame of knowledge system of warp and weft mechanics

2 Exploration and practice of the warp and weft mode of teaching Mechanics for civil engineering major of applied technology undergraduate

2.1 Thoughts on theoretical mechanics teaching of civil engineering major in applied technology undergraduate

The effective transfer of classroom knowledge is based on students' interest and, more importantly, on students' active interest. In the course of Theoretical Mechanics, which the students of civil engineering major first come into contact with, the mainstream theoretical mechanics textbooks mainly have three modules: statics, kinematics and dynamics. Statics foundation is especially important in civil engineering. The main contents are: mechanical simplification, modeling and calculation, force analysis, and balance of force system. On the one hand, the content of kinematics and dynamics is compressed a lot in class hours, on the

other hand, the content is highly generalized and abstract, which is difficult for students to understand.

Traditional teaching has developed from offline to partly online and all online, just as the initial teaching methods from blackboard writing to PPT which brought teachers a big shock. "Danger" and "Opportunity" coexist to achieve the effectiveness of online teaching .

2.2 Platform Overview

In the wave of "Internet +", the learning wall have been broken by learning cloud platforms such as MOOC(Massive Open Online Courses). More learners have the possibility of life-long learning, and for professional learners, SPOC(Small Private Online Courses) is more targeted and interactive. Superstar Learning platform is one of many professional mobile learning platforms with electronic books, newspaper articles and metadata of Chinese and foreign literature. Relying on the powerful digital resources and functional sections of books and documents, teachers can set up rich learning materials and students can complete the library borrowing inquiry, electronic resource search and download, library information browsing, and group discussion when learning courses.

2.3 Teaching organization and realization of warp and weft network mechanics knowledge

2.3.1 Warp and weft teaching organization

Under the guidance of the concept of large-scale engineering [5] -[7], relevant knowledge is reproduced at the interweaving nodes where the major knowledge is the latitude line and mechanics knowledge is the longitude line, so that students can have a three-dimensional understanding. Taking the cross point of simplification of distributed load as an example, first of all, the longitude and latitude matrix of the knowledge point is extracted based on the relevant contents of the previous and subsequent contents (see Table 1).

Table 1. The longitude and latitude matrix of distributed load simplified knowledge points

Simplified of Distributed loads	structural mechanics	Soil mechanics	concrete structure design principles	Load specifications
Uniform load	√		√	√
Triangular load		√		√
Trapezoidal load		√		√
Other shape loads	√		√	√

Then, the relevant mind map is given in the lecture, so that students can understand that this knowledge point is no longer separated, and it is highly enlightening, and will be supported in the subsequent courses.

For the cross-knowledge points that appear in the syllabus of Mechanics, it should be indicated that the students should review the knowledge points in advance and give them in the teaching calendar. Put forward the requirements of preview before class, make full use of time in class to teach related, and appropriately connect with subsequent knowledge to expand.

The core engineering cases of civil engineering can also be broken down into several overlapping knowledge points, and this professional global concept can be extended to other mechanics teaching.

2.3.2 Preparation of teaching materials

Under the guidance of warp and weft integration, the teaching resources are organically arranged in combination with the functional modules of learning. For example, the SPOC class is embedded calculus related knowledge in the inner pages of the book for timely review and summary. Embed with a large number of engineering data images, the SPOC class established effective links between mechanical modeling,and accurately derive through video.

Take the preparation of teaching materials with the simplified of distributed load as an example, see Table 2 for details.

Table 2. diagram of teaching materials on distributed load within the platform

realization module	audio video	picture	book	expansion reading	Discussion	survey questionnaire	Live broadcast
Calculus knowledge			√				
Mechanical preparation	√	√					
Mechanical conclusion	√	√			√		
Apply series				√	√	√	
Dispel doubts						√	√

2.3.3 Teaching interaction design and implementation

After designing the teaching content and materials in line with the warp and weft-type mechanics knowledge, relying on the interaction and real-time monitoring function of the SuperStar Learning platform, the content is designed into a learning loop before and after class.

The progress is controlled through the release mode (entry/open), and the big data of student attendance statistics is registered.

In the class, the mind map of knowledge structure was further demonstrated and explained. The students learned in time through learning videos and live broadcasts. Meanwhile, the contents of books and extended reading were selectively set as task points to extend the length of learning. Timely interaction, including the electronic whiteboard for exercise explanation, questionnaires and tests for knowledge points to further answer questions are presented.

In the summary section after class, group tasks were set, students were encouraged to discuss by themselves with existing tools and means, and the homework was assigned in a timely manner. In addition to the basic principle and calculation work. Situations were created and open assignments were assigned, such as looking up datas and writing a review of sources. After learning the momentum theorem, the session which enlightens students to think about whether a circular wheel rotating around a fixed axis could be described by the momentum theorem is setted, leading the students to further contact the moment of momentum theorem with questions.

2.4 Micro classroom to achieve continuous advanced supplement

How to guide students to learn continuously and effectively outside the classroom? The second class [8] -[10] is a good window. Online, students of Mechanics Association can be launched on the superstar platform to organize a series of lectures, which are supplemented by short videos for understanding difficulties. Firstly, questionnaires were collected, then the teachers explains the error-prone points or students were encouraged to record videos in groups to complete the discussion summary. To improve students' sense of participation in mechanics and strengthen students' understanding and application of basic concepts of mechanics, the study and their feelings for a certain topic in stages are shared after reading. The core engineering case base is displayed in the micro-class, and the knowledge points of mechanics are posted to students through a flipping class. Mechanics can be close to life and engineering. For example, in the teaching of virtual displacement, students need to make a change from vector method to energy method to understand the balance of the physical system. Quite a few students cannot turn the corner temporarily. In class, the modeling and analysis of the scales are introduced to guide students to observe various expressions of statics solutions. Considering that the understanding mode of the virtual work principle of deformable body in subsequent structural mechanics courses is based on the virtual work principle of rigid system, video explanation is given in micro-class in addition to classroom teaching on the application of the virtual displacement principle of rigid body in structural mechanics, including the displacement calculation of statically determinate structures caused by the movement of supports.

3 Conclusions

Under the wave of Internet+, the traditional teaching method has been changed. Aiming at the attempt to create the warp-and-weft type mechanics knowledge network, this paper provides a new idea of effective connection between mechanics and professional courses teaching.With the help of the rich database and powerful data tracking function of the Superstar Learning platform, the learning materials are integrated around the core cases of civil engineering majors. At the same time, the professional knowledge are infiltrated. The establishment of a mechanics knowledge framework of warp and weft is helpful to improve students' vision. It can be used as a reference for other majors' teaching.

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