Big Data Personalized Teaching Under the Guidance of Ideological and Political Courses

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Abstract. To implement the fundamental task of cultivating students with moral character and the goal of constructing new engineering disciplines, this paper addresses the issue of how to apply teaching methods to students with diverse backgrounds. With the guidance of curriculum ideology, based on the teaching objectives of cultivating innovative electrical engineers in accordance with the Washington Accord, process-oriented big data analysis is used to analyze the learning situation and students' learning styles, driving the teaching mode of designing grouping and layering according to students' characteristics, ultimately crystallizing the personalized education model of new engineering disciplines driven by big data. The results showed that the proposed teaching mode can promote the progress of all students with Kolb learning style based on big data.

Keywords: curriculum ideology · big data · Kolb learning style · personalized education

1 Introduction

In the era of big data, major universities, as the main battlefield for carrying out the work of cultivate students' morality and abilities through tailored education, have achieved improvement in personalized and precise professional education led by curriculum ideological education. Big data technology has become a scientific force to promote revolutionary innovation and change in the education system [1]. Norwegian universities (2022) use big data analysis to support curriculum design practices [2].

In response to the challenges faced by the development of big data, such as difficulties in teaching mode for diverse student backgrounds, smart classrooms have been adopted in China to provide convenient conditions for collecting teaching data in an all-dimensional and all-process manner [3]. Pan and Zhao (2019) built a precise teaching reform information platform and implemented a precise teaching model combined with online teaching research [4]. Guo et al. (2021) studied personalized development under human-machine collaboration, which extends from knowledge imparting to ability shaping and quality cultivation in upper-layer precise teaching, effectively enhancing students' abilities and improving learning outcomes [5]. Data-driven learning support can influence students' learning decisions, enhancing their metacognitive level, learning outcomes, and has a significant promoting effect on both learning effectiveness and learning ability [6, 7].

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In summary, it is important to establish a correct learning purpose for students as a foundation for building an efficient personalized teaching classroom under the background of big data.

2 New Engineering Education Objectives Guided by Course Ideological and Political

President Xi Jinping emphasized the use of new media and technologies to make work more dynamic, promote the high integration of traditional advantages of ideological and political work with information technology, and enhance the sense of the times and attractiveness. Based on the guidance of course-based ideological and political education, the new engineering education aims to cultivate innovative engineers who can integrate the values and goals of sustainable development into work, and use disciplinary knowledge and technical means to solve complex interdisciplinary engineering problems. As a formal member of the Washington Accord, which is an international agreement on the mutual recognition of engineering degrees, China has formulated the engineering education accreditation graduation requirements standard based on the outcome-based education (OBE) philosophy. Therefore, the new engineering education is student-centered and problem-based learning, emphasizing the cultivation of students' creative learning and thinking abilities. The teaching objectives are knowledge-oriented, ability-shaping, and quality-cultivating.

3 Individualized Teaching Based on Big Data

3.1 Kolb Learning Style

Studying and understanding students' learning styles can help teachers apply suitable teaching modes, allowing students to maximize their learning potential and achieve ideal teaching results. David Kolb believes that the learning process cycle consists of four interrelated stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation [8]. This analysis of the learning process helps to understand the essence of learning, guiding students to master learning patterns and learn "how to learn".

Kolb's Learning Style Inventory (KLSI-1984) consists of 12 questions, and based on matching the descriptions in each option with the individual's past learning experiences in various subjects, a student's learning style model is established using the four-quadrant method, as shown in Fig. 1.

Based on different learning styles, students are divided into four categories: imaginative, theoretical, pragmatic, and active learners. In an excellent team, the four roles of organization and coordination (imaginative), theoretical reasoning (theoretical), problem solving (pragmatic), and practical implementation (active learners) are indispensable. The intelligent complementarity of group members can help each other learn, and sharing diverse learning outcomes can help understand and solve problems from multiple perspectives. It can be seen that these four types of learning styles have different characteristics and there is no value judgment of superiority or inferiority. They have a certain

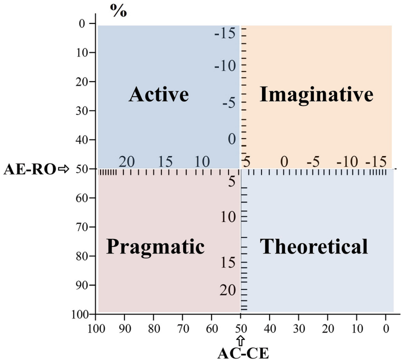

Fig. 1. Kolb's Learning Style Classification Translation

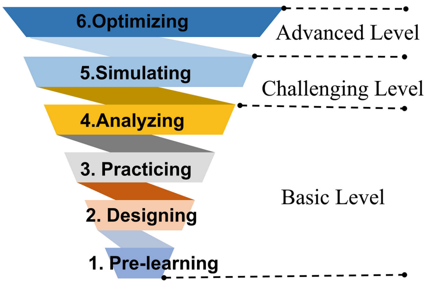

Fig. 2. Grouped and Layered Teaching Diagram

complementarity, and this difference should be considered in the design of educational projects. Different teaching methods should be designed to tap the strengths of each type of learner.

3.2 Teaching Methods Tailored to Individual Needs

1) Online premium videos, ideological and political courses

The use of high-quality video courses is suitable suitable for theoretical students to acquire new knowledge. Each lesson is introduced with practical cutting-edge cases, which stimulates the interest of pragmatic students. At the same time, questions are posed to encourage imaginative and active students to actively think and verify their ideas, making their learning more proactive and efficient. Flexible class schedules are adopted, so that students with different learning styles can arrange their studies according to their high-energy periods.

2) Grouping and layering project-driven flipped classroom

After online learning, the offline grouping and layering project-driven flipped classroom is adopted for teaching, as shown in Fig. 2.

① Basic Level: All students are required to complete pre-learning materials, discuss and design their own plans in groups, practice hands-on activities in class after being approved by the teacher, and analyze the results after class. This solves the problem of students' lack of participation in teaching activities and achieves the goal of effectively consolidating theoretical knowledge.

② Challenging Level: Students are encouraged to challenge engineering simulation programming in conjunction with other courses to solve the problem of students' lack of integration of multiple courses, and achieve the goal of flexible application of knowledge.

③ Basic Level: Students who have spare capacity can optimize control plans to solve the problem of students' lack of application of knowledge and achieve the goal of using innovative thinking to solve complex problems.

Based on the outcome-based education (OBE), layered teaching meets the diverse needs of students, and enhances the engineering knowledge and skills of students at different levels.

4 Data-Driven Process Evaluation and Personalized Error Correction and Improvement

Using the "Kolb Learning Style Inventory" to test students' learning strategies and tendencies, and dividing them into four-person groups by learning type, it was found that among the class of 2019 measurement and control class students, 50% were pragmatic, indicating that most students like to apply theoretical knowledge to practical use and execute tasks; 31% were imaginative, with rich imagination and a preference for group activities and discussions; 9.5% were theoretical, liking to analyze problems through theoretical deduction; and 9.5% were active, with strong execution ability.

Based on the characteristics of the measurement and control students, the teaching plan was adjusted, with pragmatic students as group leaders, using engineering applications as the main line to present problems; with imaginative students leading brainstorming sessions; with theoretical students explaining the derivation process of formulas, and active students summarizing. During online video conferences, more emphasis is placed on theoretical students explaining the meaning of model formulas, while offline classes focus on project-based learning and flipped classrooms through group discussions, allowing everyone to search for practical application cases and solve problems using the learned application systems, while also digesting and absorbing theoretical knowledge. By adjusting the course content and organizational form according to the learning types of students in different majors and courses, teacher aims to achieve precise teaching with unchanged textbooks but diverse cases, unchanged goals but diverse forms, and unchanged knowledge but diverse levels.

Adhering to the practice of competition to enhance practical application ability, it is easier to stimulate pragmatic and active learning, and it also requires imaginative organization and theoretical participation. Encouraging students to participate in some competitions can enhance students' interest and expand their abilities in scientific knowledge and engineering applications. It also promotes mutual learning and cooperation among team members with different learning styles, and stimulates active learning through competition-based learning and peer-assisted learning, achieving the effect of complementing each other's strengths and weaknesses.

5 Conclusions

This article, guided by the ideology and politics course, establishes teaching objectives for students' graduation requirements based on the Washington Accord engineering certification. The Kolb Learning Style Inventory is used to collect big data, and a student learning style model is established using the four-quadrant method. Teaching activities are then implemented through four-step progressive learning in grouped and layered settings, with online teaching statistics and student feedback used to further analyze the learning effects of different teaching methods. The results show that grouping students by learning style and promoting mutual learning within groups based on individual online self-study can enhance learning and cooperation abilities. Choosing layered projects can improve critical thinking and design abilities. It is evident that personalized teaching based on big data under the guidance of the ideology and politics course can effectively achieve students' comprehensive development in knowledge transfer, skill development, and character cultivation.

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