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Higher Algebra Ideological and Political Course Teaching Based on the KSA-PBL-OBE-E^2 Model

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Abstract: In the context of ideological and political education in courses at universities nationwide, to cultivate high-quality applied talents, a higher algebra ideological and political course system is established by selecting and combining quality ideological and political resources, categorized according to the nature of the higher algebra course. On the foundation of this course system, a new educational model is formed, targeting KSA, utilizing PBL as the method, and adopting OBE as the guiding philosophy for the implementation of course content. This model also innovates past terminal evaluations and teacher ratings, employing the BOPPPS teaching model for E^2 evaluation. The integration of this educational model innovation, termed KSA-PBL-OBE-E^2, has a positive impact on the implementation of the higher algebra ideological and political course, greatly promoting the cultivation of high-quality applied talents.

1. Innovation of the KSA-PBL-OBE-E^2 Educational Model

The international KSA educational theory divides education into capabilities like Knowledge, Skill, and Attitude. While Knowledge and Skills are relatively easier to acquire and enhance, Attitude is a crucial determinant of the former and a significant indicator of lifelong learning. However, "Attitude" in this context extends beyond mere disposition; it encompasses ideological and political education, related value concepts, and life attitudes. In the higher algebra ideological and political course, Knowledge encompasses basic mathematical theories and concepts, Skills include software operation, research on math-related problems, and model building, and Attitude focuses on excellent resources that can be integrated with higher algebra under the ideological and political education framework, such as patriotism, scientific spirit, and personal qualities.[1-3]

PBL (Problem-Based Learning) is a student-centered teaching method that fosters autonomous learning by situating learners in problem-based contexts, thereby promoting self-directed and lifelong learning skills. As a fundamental aspect of mathematical disciplines, higher algebra needs to break away from the inefficiencies of traditional didactic teaching and focus on student engagement and comprehension, hence the adoption of the PBL teaching model for improvement in this paper.

OBE (Outcome-Based Education) emphasizes educational results and competency orientation. The ultimate goal of higher algebra ideological and political course education is to nurture well-rounded, high-quality applied talents through the cultivation of knowledge theories, practical activities, and value concepts.

E^2 (Double-Evaluation) builds on the traditional final and teacher evaluations by incorporating formative assessment and student self-evaluation. This innovative approach combines process and outcome evaluations, breaking away from the traditional model where teachers were the sole evaluators. It emphasizes the significance of both teacher and final evaluations while prioritizing student and formative evaluations, thus making student self-evaluation a critical component of the assessment process. This reform in evaluation methods ensures students' role as the primary learners, supporting the strategy of fostering virtue through education and effectively promoting the ideological and political aspects of the course. The introduction of the E^2 evaluation method breaks down the barriers between different types of evaluations, moving away from the traditional 2E (teacher evaluation + final evaluation) teaching evaluation method. It adheres to the principle of mutual consideration and joint education, harnessing the integrated teaching effects of E^2, thereby realizing innovation in educational models and forming the KSA-PBL-OBE-E^2 educational model.[4]

The KSA-PBL-OBE-E^2 educational model forms a systematic educational approach through the establishment of training objectives, choice of teaching methods, guidance in educational orientation, and innovation in evaluation methods. While this model aims to cultivate high-quality talents and focuses on the comprehensive development of high-quality applied talents, it emphasizes the cultivation of students' Attitudes in the KSA part, as this is the core of the higher mathematics ideological and political course. The higher algebra ideological and political course, implemented through this educational model, emphasizes student autonomy and employs a combination of multiple evaluations to assess talent cultivation, thus promoting the development of high-quality applied talents. The systematic structure diagram of the KSA-PBL-OBE-E^2 educational model is illustrated in the figure 1. [5]

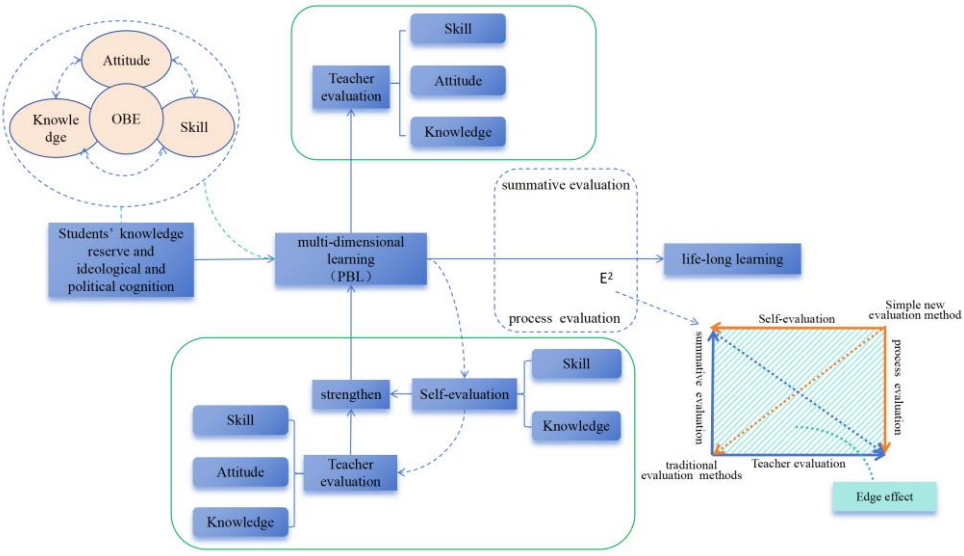

Figure 1: The systematic structure diagram of the KSA-PBL-OBE-E^2 educational model

2. Selecting Ideological and Political Resources to Build a Categorized Construction System

With a focus on different aspects of the higher algebra course content, the ideological and political construction of the course diverges from traditional formative evaluation methods. It should be categorically constructed based on the attributes of the course content for better teaching outcomes. The higher algebra ideological and political system comprises three parts: the theoretical knowledge part, mainly delivered through flipped classrooms; the MATLAB practical operation part, taught with IT assistance under the CDIO model; and the expansion and extension part, mainly through the establishment of a resource library allowing students to autonomously engage in secondary classroom

learning, thus effectively enhancing and supplementing the primary classroom with self-directed learning. The detailed and effective division of the ideological and political course construction system, selection of ideological and political resources, integration of course ideology and politics, and implementation of teaching design are key to the success of the higher algebra ideological and political course.

For the selection of ideological and political resources, this paper focuses on the socialist philosophical system, traditional Chinese culture, scientific spirit, personal quality, and ideal education as the basic resources. In the design and implementation of teaching, the model adheres to the principles of explicit and implicit integration, following the KSA-PBL-OBE-E^2 educational model for effective teaching. In integrating ideological and political resources with higher algebra, under the socialist philosophy aspect, the course effectively combines the unique logical attributes of higher algebra, such as connection and development, necessity and chance, and the negation of negation. In terms of traditional Chinese culture, extracurricular algebra-related resources can be utilized to make students appreciate the excellent historical culture created by Chinese scholars, learn the development history of Chinese mathematics, and enhance their identification with national culture. In personal quality, through the numerous and complex mathematical operations of higher algebra (or complex operations achieved through MATLAB software), students are cultivated to recognize the quality of perseverance and develop courage in facing difficulties and persistence after failure.[6] In ideal education, the second classroom can be effectively used to guide students through mathematical achievements and the deeds of mathematicians, helping them form correct comprehensive beliefs, moral qualities, value concepts, and comprehensive abilities. The scientific spirit can be cultivated in regular theoretical and practical teaching, encouraging students to question and challenge academic authority and to constantly innovate through challenges.

The implementation of this educational model can generally achieve the cultivation of high-quality applied talents. However, the educational model also requires effective supplementation of teaching methods. Excellent teaching methods are an important part of achieving the expected training effects of the educational model, and exploring effective teaching methods is also crucial in talent cultivation. Teachers should motivate students' learning interest and enthusiasm in daily educational teaching, transforming their curiosity into a scientific desire for knowledge, cultivating students to observe the world with a scientific perspective and thinking, and fostering their learning qualities through methods such as situational creation, thereby comprehensively nurturing students' comprehensive qualities and value concepts.

3. E^2 Evaluation

In evaluating the effectiveness of the higher algebra ideological and political course, student evaluation, as a key focus of teaching, should also become an important metric, alongside teacher evaluation. From the perspective of moral education and the essence of course politics, student evaluation is more important than teacher effectiveness evaluation. Traditional teacher evaluations, although including student assessments, often fail to fully cover and observe the students' learning process, leading to a significant oversight of formative student evaluations. This paper proposes adding student E^2 evaluation, namely formative and summative evaluations, as important indicators for teaching effectiveness detection, separate from traditional summative evaluations. The theoretical foundation and practical implementation of summative evaluation in the teaching evaluation system are already well-developed. This paper will focus on the design and implementation of formative evaluation: mainly targeting the theoretical knowledge and practical operation parts for reform implementation, based on the problem-guided teaching characteristics of PBL, using the BOPPPS teaching model: Bridge-in, Objective, Pre-assessment, Participatory learning, Post-assessment,

Summary.

Different from the traditional BOPPPS teaching model, in the assessment of the higher algebra ideological and political course, besides testing knowledge and skills, more attention is paid to changes in students' political abilities in the classroom. Appropriate teaching methods need to be adopted to evaluate both students' knowledge, skills, and emotional values. Therefore, this course's BOPPPS model, based on its original process, mainly supplements the Pre-assessment, Participatory learning, and Post-assessment phases. For Participatory learning, the ideological and political content of the course is implemented through PBL teaching. For Pre-assessment and Post-assessment, knowledge testing, apart from students' self-examination and reflection, mainly involves effective means such as teachers' tests, questioning, and student presentations. For example, tests can be published on online educational platforms like Xuetong before learning, questions and discussions can be initiated during the learning process based on the feedback from Pre-assessment, and tests can be published again after learning. This method ensures overall monitoring and examination of students' learning and goal achievement, achieving formative evaluation of theoretical knowledge and practical operation.

For assessing students' political levels, Pre-assessment and Post-assessment can use emotional attitude questionnaires or teacher-student interviews. In designing questionnaires and interviews, attention should be paid to the emotional and linguistic expression of the questions, fully considering students' mental health. For example, using subtle questionnaires such as "How do you feel about the nation after this class?" can effectively observe changes in students' political situations compared to Pre-assessment levels. During the learning process, teachers should fully observe students' emotional states, participation in groups or teams, seriousness in learning or operations, and emotional attitudes in presentations or communications. Through effective monitoring and analysis of students' political levels based on these observations, timely adjustments can be made. However, due to the long-term nature of political cultivation, short-term observations and tests might show unclear or fluctuating results. Therefore, teachers and management should keep long-term records of students' growth, analyzing these records for effective long-term adjustments to ensure improvement in students' political abilities and achieve formative evaluation of political levels.

In the outcome evaluation of the higher algebra ideological and political course, teacher evaluation is also an important indicator. Teacher teaching effectively reflects relevant teaching outcomes and students' achievement of goals, thus informing the formative evaluation of students. Although the relevant theories of teaching evaluation are already somewhat systematic, in the teaching evaluation of the higher algebra ideological and political course, various experts, teachers, and administrators should further refine teacher evaluation indicators. On top of traditional knowledge frameworks and teaching methods, add indicators related to ideological and political teaching, such as entry points for course politics, integration points of specific content, and emotional resonance points. Under established teaching indicators, education evaluators should also continually refine evaluation methods, such as optimizing weight assessment by modifying the weight design of teaching evaluation indicators. This ensures that the course and politics are aligned and jointly effective. Through effective evaluation and feedback of teaching, teachers can improve their ideological and political teaching in the course, enhancing students' understanding of the course and their political level, thus cultivating high-quality applied talents.

4. Conclusion

Through the integration of ideological and political elements and the construction of a system in the higher algebra course, and by implementing the KSA-PBL-OBE-E^2 educational model, complemented by scientific teaching methods, effective cultivation of relevant qualities in students

can be achieved. Simultaneously, under the premise of optimizing evaluation mechanisms, teachers can enhance themselves through E^2 evaluation feedback and professional development pathways. This approach also ensures effective examination and cultivation of students' abilities and qualities, endowing them with the traits of autonomous and lifelong learning, thus shaping them into high-quality socialist applied talents.

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References

[1] Zhu Zhifeng, Bai Yanping. Drawing on PBL Teaching Methods to Reform the Teaching and Assessment Model of "Higher Algebra". Mathematics Learning and Research, 2018(09):22-23.
[2] Hu Jiancheng, Zhou Yuqian, Yang Ren. Exploration and Practice of Blended Teaching of Linear Algebra under the Concept of OBE. University Mathematics, 2022, 38(01):32-37.
[3] Niu Fang, Xu Jinli. Reform and Practice Model Construction of International Trade Specialty Course System Based on KSA Model. Jiangsu Science and Technology Information, 2015(27):25-28.
[4] Li Zhenhong, Ke Xugui, Wang Anzhe, Zha Guangcheng. Application of Information Technology in Formative Assessment of Courses. China Metallurgical Education, 2022(02):31-32.
[5] Sun Ying, Zhong Anshi. A Brief Analysis of the Reform of Applied Education Model in Independent Colleges. Education and Teaching Forum, 2018(45):141-142.
[6] Cheng Le, Liu Di, Wang Hui. Strategies and Practice of Ideological and Political Education in University Mathematics Courses: Taking Higher Algebra Course as an Example. Modern Vocational Education, 2022(15):37-39.