International Journal of Scientific Engineering and Science
Volume 10, Issue 3, pp. 48-52, 2026. ISSN (Online): 2456-7361

Teaching Reform and Practical Exploration of "Discrete Mathematics" from the Perspective of the Integration of Smart Teaching and Ideological and Political Education in Courses

Zhang Xu
School of Computer and Information, Anqing Normal University, Anqing, China

Abstract—*To break through the traditional teaching predicament of Discrete Mathematics, promote the deep integration of smart teaching and ideological and political education in the curriculum, and implement the task of cultivating talents and fostering virtue in "new engineering", this study explores the path of high-quality construction of ideological and political education in the curriculum. Using the research method of combining theory with practice and multi-dimensional collaboration, the study was carried out from three aspects: connotation deepening, teaching innovation, and team foundation building: In terms of connotation, a framework of "value guidance , knowledge imparting and ability cultivation" was constructed, and ideological and political elements were explored in combination with course modules and integrated into cases; In teaching, build a full chain ideological and political system of "pre-class preview - inclass study - post-class practice", and innovate blended teaching based on smart platforms; In terms of teams, form a community of "ideological and political course teachers, counselors and professional course teachers" and establish a training mechanism. The research has optimized the construction of teaching teams, enhanced students' initiative in learning, achieved the unity of knowledge, ability and value cultivation, provided practical references for the construction of ideological and political education in engineering courses, and proved that multi-dimensional collaboration can effectively promote the deep integration of ideological and political education with professional teaching.*

Keywords—*Discrete Mathematics; Curriculum-based ideological and political education; New Engineering; Smart teaching; Educational model.*

I. INTRODUCTION

Discrete Mathematics, as a core foundation course for computer science and related majors in higher education institutions, is key to supporting subsequent professional courses such as programming and artificial intelligence, and plays an irreplaceable role in cultivating students' logical reasoning ability and problem-solving ability. However, the course is characterized by its theoretical obscurity and strong practical operation, with closely linked knowledge points and high requirements for learners' comprehensive quality. For a long time, there have been common problems such as high difficulty for teachers to teach, high entry threshold for students, and difficulty in in-depth mastery. Under the traditional teaching mode, Problems such as students' lack of enthusiasm for learning and limited access to learning resources are more pronounced.

II. PROBLEM STATEMENT

The smart teaching model, with the unique advantages of "Internet + education"[1], breaks through the constraints of time and space, realizes the organic combination of personalized learning and online and offline blended regular teaching, and provides a feasible implementation path for the teaching reform of the Discrete Mathematics course. At the same time, ideological and political education in courses has become a key direction of current teaching reform in colleges and universities. The state has explicitly stated that all kinds of courses should work in coordination with ideological and political theory courses and move in the same direction to effectively implement the fundamental educational task of fostering virtue and nurturing talent, which also sets new standards and requirements for the teaching work of engineering majors[2].

At present, all universities in China are actively promoting the deep integration of ideological and political education with smart teaching, but in the practice of new engineering courses such as Discrete Mathematics, there are still many prominent problems that need to be solved urgently. First, the ideological and political education awareness of some teachers is relatively weak. Most engineering teachers have a tendency to emphasize the imparting of professional skills rather than the shaping of value concepts. They do not fully recognize the importance of ideological and political education in courses[3] and ignore the coordinated development of ability cultivation and value guidance, which is difficult to meet the country's demand for the cultivation of engineering talents in the new era. Secondly, the integration of ideological and political elements is rather stiff. In some teaching scenarios, there are cases of simple piling and mechanical application, and ideological and political education resources have not been deeply explored in combination with the core content of course knowledge, thus failing to achieve the implicit educational effect of "nourishing things imperceptibly". Again, the process of building teaching teams is relatively lagging behind. The existing teaching teams generally lack a strong sense of collaboration, the structure of team members is not scientifically reasonable, and the overall professional research ability and ideological and political literacy of teachers are at a relatively low level, making it difficult to provide strong support for the in-depth implementation of the "smart teaching, course-based ideological and political education" integration model. Finally,

the practical application of the integration model is not sufficient. How to rely on the smart teaching platform to effectively integrate ideological and political content into the entire teaching process of pre-class preview, in-class teaching, and post-class consolidation, and create high quality online and offline blended ideological and political gold courses, remains the core problem that needs to be focused on in the current teaching practice of Discrete mathematics.

To sum up, the current teaching of Discrete mathematics is at a critical stage where traditional teaching predicaments and new teaching reform opportunities coexist. How to effectively solve the teaching problems of the course itself, promote the deep integration of smart teaching and ideological and political education in the course, optimize the construction level of the teaching team, fully mobilize the learning initiative and enthusiasm of students, and achieve the organic unity of knowledge imparting, ability cultivation and value shaping has become an important issue that computer teaching workers in colleges and universities must face and urgently need to solve.

III. SOLUTION

For the core basic course "Discrete Mathematics" in engineering colleges, ideological and political education in the course is by no means a simple combination of ideological and political elements with professional knowledge such as set theory and graph theory. Instead, it should be based on the strategic layout of "new engineering" construction, closely adhere to the core task of moral education and talent cultivation, and combine the characteristics of the course such as strong abstraction, strict logic and wide application, We will promote the deep integration of ideological and political education with discrete mathematics teaching in a coordinated manner from the three key dimensions of connotation deepening, teaching innovation, and team building, achieve the organic unity of value guidance, knowledge transmission and ability cultivation, and fully cultivate new era "red engineering talents" capable of shouldering the responsibility of national rejuvenation[4].

A. Deepen the content: Consolidate the foundation of ideological and political gold courses

The core of the ideological and political connotative construction of the Discrete Mathematics course lies in adhering to the original aspiration and mission of cultivating people for the Party and talents for the country, precisely solving the fundamental proposition of what kind of people to cultivate, how to cultivate them, and for whom to cultivate them, promoting the transformation of ideological and political education from "surface embedding" to "deep penetration", and making abstract mathematical concepts, rigorous logical reasoning resonate with positive value guidance. As a "cornerstone course" for engineering disciplines such as computer science and software engineering, the core modules of discrete mathematics, including set theory, algebraic systems, logical reasoning, and graph theory, are the theoretical foundation of frontier fields such as artificial intelligence, big data, and cryptography. The logical thinking and modeling abilities it cultivates are directly related to the quality of cultivation of core technical talents.

The connotative development of ideological and political education in the "Discrete Mathematics" course needs to closely align with the distinct characteristics of the "new engineering" construction, combine the teaching features of each module, and construct a trinity education framework of "value guidance, knowledge imparting and ability cultivation". First, strengthen ideological guidance and vividly tell the Chinese story by combining the application cases of discrete mathematics in major national science and technology projects. For example, in the teaching of logical reasoning related to cryptography, introduce the development process of China's SM3 hash function standard to demonstrate the country's strategic determination to achieve selfreliance and strength in science and technology; The second is to emphasize the training of abilities, combining the practical attributes of the curriculum such as logical reasoning, abstract modeling, and algorithm design, and closely integrating ideological and political education with the analysis of classic examples, programming practice, problem-solving, etc., to cultivate students' rigorous and pragmatic scientific attitude, pioneering and innovative exploratory spirit, and meticulous craftsmanship spirit; Third, to cultivate a deep sense of patriotism, to explore the red genes and Chinese contributions in the field of discrete mathematics, from the limit ideas contained in Liu Hui's circle cutting technique of the Wei and Jin Dynasty, to Zu Chongzhi's precise calculation of PI, from the "Chinese postman problem" proposed by Mr. Guan Meigu, to the persistence of academician Wang Xiaoyun's team in solving international cryptographic problems, Let students deeply understand the core essence of "serving the country through science and technology" and "strengthening the country through industry" in their professional studies.

The essence of ideological and political education is reasoning, and the ideological and political education in discrete mathematics courses needs to keep pace with The Times, ensuring that teaching themes and case selections always keep up with The Times and are in line with students' cognition. We should actively explore the integration model of "smart teaching, course-based ideological and political education", and by reconstructing the teaching paradigm and optimizing the content design, remove the bottlenecks and pain points of integrating ideological and political education. Under the guarantee of collective lesson preparation and teacher-student discussion mechanisms, transform abstract ideological and political concepts into concrete teaching content, and make every knowledge point a carrier of education. For example, the "Knowledge - problem - ideological and Political" three-dimensional map constructed by the Discrete Mathematics research group at Beijing Jiaotong University deeply links ideological and political elements with the knowledge points of each chapter, providing an effective model for the construction of ideological and political content in the curriculum.

Taking the teaching of Huffman coding, the core difficulty of the "tree" module of Discrete Mathematics, as an example, the connotative construction can be implemented as a three-dimensional implementation model of "case empowerment, interdisciplinary integration and role model leadership". In

terms of case selection, the application of Huffman coding in image compression is explained in combination with the image transmission scenario of the Zhurong Mars probe, allowing students to have an intuitive understanding of the major breakthroughs in China's aerospace industry and enhance national pride; In terms of content update, it connects with the relevant knowledge of the "Digital Image Processing" course to cultivate systems thinking; In terms of ideological and political integration, it tells the story of how the team of Academician Sun Jiadong overcame the aerospace communication problem by relying on similar coding technology, and combines the story of the team of Professor Li Yunsong from Xidian University who has been deeply engaged in the spacecraft image compression task to inspire students to integrate their personal ideals into the overall development of the country. In the teaching of "equivalence relations", the concept of "equality" in the core socialist values can be combined to analogize the reflexivity, symmetry and transitivity of equivalence relations, allowing abstract concepts to naturally connect with value concepts and achieve the simultaneous advancement of knowledge learning and moral cultivation.

B. Deepening Reform: Activating the vitality of ideological and political education

The key to the reform of ideological and political teaching in engineering courses lies in breaking down the barrier of "ideological and political education being separate from the major", and achieving the organic integration and resonance of ideological and political elements with the teaching content of discrete mathematics[5].Traditional discrete mathematics teaching often focuses on the teaching of knowledge points, with emphasis on logical derivation and exercise training, and ideological and political education is often marginalized. Efficient teaching reforms require the integration of ideological and political education throughout the entire teaching process, through innovative forms such as blended online and offline teaching and flipped classrooms, to fully mobilize students' initiative and truly integrate ideological and political education into every aspect of professional learning.

The ideological and political teaching reform of the Discrete Mathematics course should start with the reconstruction of the course chapter system, deeply embed ideological and political elements in every link such as knowledge point selection, teaching implementation, and effect evaluation, and construct a full-chain ideological and political integration system of "pre-class preview - in-class study - post-class practice" (as shown in Figure 1). This full- process integration is not a simple superposition but a deep coupling of ideological and political education with professional teaching, allowing students to be imperceptibly guided by value in the process of studying set operations, graph theory modeling, and logical reasoning, achieving simultaneous improvement of "learning knowledge, strengthening ability, and cultivating character".

The core of the pre-class stage is to do a good job in the excavation of ideological and political materials and pre-guidance. Teachers should dig out ideological and political elements around the core knowledge points of each chapter from dimensions such as the deeds of scientists, national strategic achievements, and the development history of algorithms, organize and form a smart teaching resource package including micro-videos, literature materials, and case analyses, and upload it to the online platform for students to preview independently.

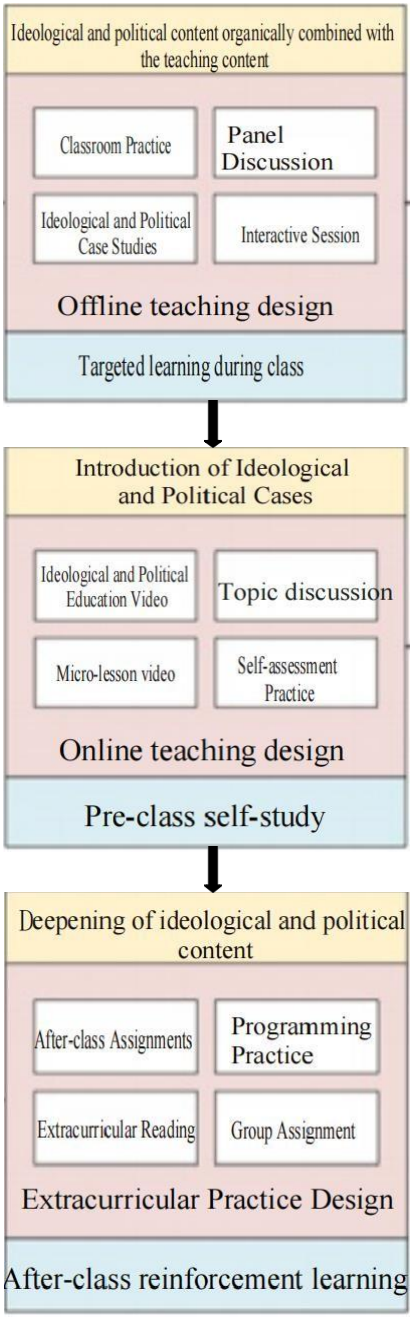

Figure 1. Pre-class preview - in-class study - post-class practice

For example, before teaching "binary relations", push videos interpreting the correlation between the socialist core values of "equality" and equivalence relations to guide students to establish the intrinsic connection between mathematical concepts and value concepts in advance; In the preview stage of graph theory, share the background and application value of the "Chinese postman problem" to give students an initial perception of the characteristics that mathematics originates

from life and serves national construction.

The key to the in-class stage is to achieve a natural connection and in-depth interaction between ideological and political elements and professional knowledge. In the teaching process, design an introduction with ideological and political cases as the entry point, and use smart teaching tools such as online quizzes and group discussions to stimulate students' interest in learning. Smoothly transition from ideological and political content to the explanation of key and difficult points, precisely answer common questions from preview feedback, and finally solve practical problems through algorithm application, leading students to understand the latest progress in the field. For example, when explaining "the division and coverage of sets", draw analogies to the concept of "categorizing policies" in national governance to guide students to understand the thinking method and systems concept of "divide and rule"; When explaining the "syllogism" of logical reasoning, combine rigorous verification cases in scientific research to cultivate students' pragmatic attitude towards learning. The teaching model of "Smart classroom + Flipped classroom +SPOC" at Beijing Jiaotong University enables students to study basic content independently outside of class and focuses on discussion and practice in class, providing an efficient carrier for the deep integration of ideological and political elements.

After class, the focus is on consolidating the teaching effect, deepening ideological and political understanding, and achieving "unity of knowledge and action". Consolidate theoretical knowledge and skills through stratified assignments, programming practices, etc., and design targeted group tasks to allow students to independently look up information, improve algorithms, and explore ideological and political connotations. For example, after the "Graph Theory" class, assign the "Urban Traffic Network optimization" modeling task to guide students to think about problems in the context of national strategies such as rural revitalization and new urbanization; Organize discrete mathematics teaching competitions, algorithm innovation practices and other activities to enable students to deeply understand the connotation of ideological and political education through lesson preparation, teaching and practice, and achieve the transformation from "passive acceptance" to "active practice". These after-school extension activities enable ideological and political education to break through the boundaries of the classroom and transform into students' conscious actions and intrinsic qualities.

C. Strengthening the Foundation: Ensuring the construction of ideological and political education

The high-quality construction of ideological and political education in the Discrete Mathematics course cannot do without a highquality teaching staff with excellent political quality, solid professional foundation and outstanding educational ability. The abstract and logical nature of discrete mathematics requires teachers to be proficient in professional knowledge such as set theory and graph theory, and to accurately grasp the scale of integration of ideological and political education to avoid "rigid preaching" and "knowledge disconnection". In accordance with the standards of a "four-have" good teacher and the "six musts" requirements for ideological and political course teachers, strictly controlling the entry, ability and education of teachers, and strengthening ideological, professional and professional ethics construction is the core guarantee for promoting the continuous deepening and solidification of ideological and political education in the curriculum.

Building a collaborative education mechanism is an effective way to enrich the ideological and political teaching staff of Discrete Mathematics. By integrating the forces of ideological and political course teachers, counselors, and discrete mathematics professional course teachers, a "trinity" education community is formed to achieve complementary advantages. Ideological and political teachers assist professional teachers in accurately grasping the direction of ideological and political education, ensuring that the integration is not off track or stiff; Counselors are familiar with students' ideological trends and growth needs, provide personalized ideological and political guidance, and connect classroom education with daily education; Professional teachers delve deeply into the course content, precisely identify the integration points of ideological and political education in each module, and promote the natural connection between professional knowledge and ideological and political education. For example, during collective lesson preparation, ideological and political teachers provide theoretical support, professional teachers design cases based on modules such as "Algebraic systems" and "logical reasoning", and counselors provide feedback on students' cognitive characteristics to jointly optimize the teaching plan.

Teachers themselves should establish the concept of lifelong learning and take the initiative to adapt to the requirements of ideological and political education in the new era. On the one hand, continuously deepen the understanding of discrete mathematics expertise, keep track of the frontiers of the discipline and national strategic demands, and integrate the latest research achievements and application cases into teaching; On the other hand, constantly update ideological and political content reserves, enhance the application ability of smart teaching tools, and explore the integration points of courses and ideological and political education from multiple perspectives. The Liu Duo teaching team at Beijing Jiaotong University has been working hard for more than ten years to create national firstclass courses, compile high-quality teaching materials, and build a library of ideological and political case resources. Their experience shows that only when teachers themselves have both professional qualities and ideological and political sentiments can they integrate personal charm and educational concepts into the entire teaching process and become guides and mentors for students' healthy growth.

IV. CONCLUSION

The high-quality construction of ideological and political education in engineering courses in the new era is a systematic project. For "Discrete Mathematics", only by taking the construction of connotation as the foundation and anchoring the characteristics of the course to explore the educational value can it be achieved. Take teaching reform as the starting point

and achieve deep integration throughout the entire process; With team building as a guarantee and a solid foundation of teaching staff to build a strong defense line for education, the three dimensions can support each other and work together to truly achieve the deep integration of ideological and political education and professional education. The practice of ideological and political construction in the Discrete Mathematics course fully demonstrates that only by deeply integrating ideological and political concepts into the course content, running through the entire teaching process, and relying on a high-quality teaching team, can the ideological and political golden course truly take effect, allowing students to master professional abilities such as logical reasoning and modeling operations while cultivating a sense of patriotism and cultivating a scientific spirit, Let the spirit of "building industry for the country" be passed down from generation to generation, and inject continuous youthful vitality into the construction of a strong education and science and technology country.

ACKNOWLEDGMENT

This paper thanks the following projects for their support. Fund Project: General Teaching and Research Project of the University (2024aqnujyxm58); Provincial "Four New" Research and Reform Practice Project (2024sx086).

REFERENCES

[1] Zhang Bo, Jiang Hong. Teaching Reform of Mechanics of Materials Based on "Internet + Research" in the Context of New Engineering [J]. Western quality education, 2021, 7 (23): 132-133.
[2] Luo Guoqin. The Impact of Higher Mathematics Teaching Reform on the Enhancement of Professional Competence of Engineering Students [J]. Industry and Science & Technology Forum, 25,24(10):112-114.
[3] Wang Xiaohua, Wang Ronggui, Yang Juan, Li Shujie. Ideological and Political teaching and scientific thinking ability cultivation in Discrete Mathematics curriculum [J].Computer Education,2025(12):216-223.
[4] Feng Yuncong, Zhang Xiaoli, Xiao Wei, Xu Zhongyu, Wang Tao. Discrete mathematics curriculum teaching design and application of ideological elements analysis [J]. Computer knowledge and technology, 2024, 20 (18): 117- 120.
[5] Yan Chaokun, Wang Jianlin, Zhang Yanfeng, Zhang Yi, Luo Huimin. Teaching design and Practice of Ideological and Political Education in Discrete Mathematics [J]. Journal of Higher Education, 2020,11(5):173-176.