

Research on the Pathways and Practices of Integrating Chinese Philosophy into Advanced Mathematics Teaching

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Abstract

Advanced Mathematics is a core theoretical foundation course for science, engineering, and economic management majors in universities, and students' mastery of it directly affects their subsequent professional learning and the development of comprehensive literacy. Due to the high abstractness and strong logicity of the course, students are prone to a sense of fear of difficulty, which reduces their learning well-being and even leads to deviations in self-cognition. With the in-depth advancement of the concept of Curriculum Ideological and Political Education, exploring the inherent alignment between Chinese philosophical thoughts and Advanced Mathematics teaching to realize the synergy of cultural immersion and literacy cultivation has become an important direction of teaching reform. The dialectical thinking and self-cultivation wisdom contained in Chinese philosophy are highly consistent with the educational goals of Advanced Mathematics. Combining core knowledge points of Advanced Mathematics such as extreme values and the infinitesimal method, this paper explores the specific pathways for integrating the core concepts of Chinese philosophy into teaching, provides practical references for the reform of Advanced Mathematics teaching, and promotes the application and inheritance of Chinese philosophical wisdom in science and engineering courses of universities.

Keywords

Chinese Philosophy; Teaching Integration; Cultural Inheritance.

1. Introduction

As the essence of traditional Chinese culture, Chinese Philosophy, in a narrow sense, includes the thinking methods, value criteria and self-cultivation concepts in classical classics; in a broad sense, it covers the inheritance and evolution of ideological schools, the accumulation and continuation of humanistic spirit, and the positive guidance for individuals to settle down and achieve growth and development. The thinking enlightenment, literacy cultivation and value guidance functions embodied in it are in the same vein as the ideological methods, scientific spirit and educational core carried by mathematical culture [1]. Among them, the core wisdom of Yin-Yang complementarity and dialectical unity is deeply consistent with the mathematical logic of Advanced Mathematics, providing profound cultural support for the teaching reform of Advanced Mathematics, which also reflects the inherent connection between philosophy and mathematics in teaching integration [2].

Advanced Mathematics is featured by high abstraction, rigorous logic and wide application, and it is an important carrier for cultivating students' rational thinking and problem-solving abilities. However, in the current teaching practice, the classroom still takes the explanation of knowledge points and the training of problem-solving skills as the core, which makes the course labeled as "boring" and "hard to understand". Students' learning enthusiasm is low, and there is even a cognitive bias of "valuing skills over concepts" [3]. Some students generate self-denial due to long-term learning setbacks, which has a negative impact on their learning

well-being and self-cognition. How to break this dilemma through teaching innovation has become an urgent problem to be solved in the current teaching reform of Advanced Mathematics [4].

There is a high degree of compatibility between the core ideas of Chinese Philosophy and Advanced Mathematics in terms of thinking mode and educational goal. Deeply integrating the philosophical wisdom such as "Tao follows nature" and "dialectical unity" with the knowledge points of Advanced Mathematics can not only help students strengthen their understanding of knowledge and improve their problem-solving abilities, but also guide them to adjust their mindset, improve their self-cognition and gain lasting learning well-being, which is also in line with the trinity educational goal of "knowledge imparting, ability cultivation and value guidance" of Curriculum Ideological and Political Education [1]. Based on this, this paper focuses on the pathways and practical value of the integration of Chinese Philosophy and Advanced Mathematics teaching, and provides new ideas for improving the quality and efficiency of Advanced Mathematics teaching and promoting the all-round development of students.

2. Organic Integration of Chinese Philosophy in Advanced Mathematics Teaching

2.1. Integrating Dialectical Thinking and Law Awareness Based on Core Knowledge Points

The inherent laws of core knowledge points of Advanced Mathematics such as extreme values and the infinitesimal method are highly consistent with the dialectical thinking and law awareness of Chinese Philosophy. In teaching, philosophical thoughts can be deeply combined with knowledge points, enabling students to comprehend the essential laws of things' development while mastering knowledge points, which is also the core embodiment of the integration of philosophical thoughts and mathematical culture in Advanced Mathematics teaching [2]. In the teaching of extreme values, combined with the dialectical wisdom of "Things turn into their opposites when they reach the extreme", students can intuitively perceive the dialectical logic of "a turning point is bound to occur after reaching the extreme" by analyzing the change law of functions from increasing to decreasing or from decreasing to increasing after the extreme point. This not only strengthens the core content such as "extreme value judgment steps", but also guides students to view prosperity and adversity in study and life dialectically. In the teaching of the infinitesimal method, the pragmatic thinking of "dividing the whole into parts" and "simplifying the complex" is integrated. When explaining the solution to the area of a curved trapezoid, students are guided to practice the wisdom of "Tackling the difficult by starting with the easy, and accomplishing the great by starting with the small" from Tao Te Ching, decomposing complex figures into countless small rectangles and solving problems through the steps of "decomposition-approximation-summation-taking the limit". This not only helps students master the core logic of the infinitesimal method, but also conveys the working method of "breaking big things into small ones and taking the first step steadily". This integrated teaching method turns abstract mathematical knowledge points into concrete carriers of philosophical thoughts, which not only helps students strengthen knowledge memory and application, but also cultivates their dialectical thinking and law awareness in the learning process [5].

2.2. Exploring Mathematical Processes to Infiltrate Self-Cultivation Wisdom and Practical Character

The processes of theorem derivation, problem-solving error correction and method iteration in Advanced Mathematics are themselves practical arenas for self-cultivation wisdom. In

actual teaching, the educational value of these processes can be explored, and the self-cultivation concepts of Chinese Philosophy can be naturally infiltrated into teaching practice to realize "learning mathematics is equivalent to practicing self-cultivation". In theorem derivation, the rigorous character of "seeking truth and being pragmatic" can be infiltrated. For example, when deriving Taylor's formula and Gauss's formula, students are required to follow logical rules step by step, repeatedly verify each operation step, and correct logical loopholes in a timely manner. This process is exactly the practice of the self-cultivation requirement of "seeking truth from facts" in Chinese Philosophy, cultivating students' character of not making arbitrary judgments, not following others blindly, and being down-to-earth and rigorous, which is in the same vein as the scientific spirit advocated by mathematical culture [1]. In problem-solving error correction, the introspective wisdom of "reflecting on oneself" is actively integrated. When facing errors in integral calculation and series convergence judgment, students are guided not to avoid problems, but to investigate their own reasons such as "formula memory deviation" and "logical derivation omissions" inwardly. Just as advocated by Chinese Philosophy that "He who knows others is wise; he who knows himself is enlightened", students optimize their learning methods in reflection and cultivate the character of self-introspection and self-encouragement. In the selection of problem-solving methods, the simple concept of "Great ingenuity appears clumsy" is conveyed. For example, when solving the derivative of a piecewise function, students are encouraged to return to the "basic method" of the definition of derivative, judge the existence of the derivative through left and right limits, instead of directly applying formulas relying on flashy skills. This problem-solving idea of "valuing the foundation and making steady progress" is exactly the embodiment of the wisdom of "Great ingenuity appears clumsy" in Tao Te Ching, cultivating students' down-to-earth learning attitude of not taking opportunistic shortcuts [6].

2.3. Combining Application Scenarios to Highlight Humanistic Value and Educational Warmth

The wide application of Advanced Mathematics provides an implementation scenario for the humanistic value of Chinese Philosophy. In teaching, various application scenarios such as professional application and team learning can be combined to make students feel the practical value of mathematical knowledge and philosophical wisdom, enhance their sense of learning gain and well-being, and break the current dilemma of "boring and hard to understand" in Advanced Mathematics teaching [3]. In professional application scenarios, teachers can actively infiltrate the thinking wisdom of "dialectical choice". Taking the solution of physical variable-speed motion as an example, derivatives and integrals can be compared to a pair of "reciprocal tools", guiding students to solve problems by using the logic of unity of opposites and contradiction transformation. Derivatives "divide the whole into parts", decomposing the overall cumulative quantity into instantaneous change rates; integrals "integrate parts into a whole", restoring discrete infinitesimals to the overall total quantity. The two are interrelated, reciprocal operations, and interdependent. Teachers can naturally integrate the dialectical wisdom of "Yin-Yang complementarity and the interdependence of being and non-being" from Chinese Philosophy in this process [2]. This process not only enables students to master specific problem-solving methods, but also makes them deeply comprehend the philosophical connotation of "Difficulty and ease complement each other, and opposites transform into each other", cultivating their thinking ability of flexible transformation and comprehensive view of problems. In team learning scenarios, the equality concept of "On the Uniformity of All Things" from Zhuangzi can be actively conveyed. When organizing students to complete comprehensive tasks such as mathematical modeling in groups, students are encouraged to view the role of different variables and the value of

different problem-solving ideas equally from the perspective of "Everything is that, and everything is this", and not neglect any reasonable plan. In the process of team collaboration, the team is guided to recognize the complementarity of different ideas and respect the differentiated contributions and thinking modes of each member. Tolerating differences and integrating wisdom in collaboration not only completes learning tasks efficiently, but also cultivates the character of inclusiveness, openness and harmony in diversity, realizing the coordinated improvement of knowledge learning and humanistic literacy [4].

3. Effective Pathways to Integrate Chinese Philosophy into Advanced Mathematics Teaching

3.1. Optimizing Teaching Content and Exploring Integration Entry Points

Optimize the teaching content of Advanced Mathematics, systematically explore the integration entry points between Chinese Philosophy and Advanced Mathematics combined with the core knowledge points of Advanced Mathematics, naturally infiltrate philosophical thoughts into the explanation of knowledge points, avoid rigid stacking, and realize the coordinated advancement of "knowledge imparting and literacy cultivation" [1]. On the one hand, in the explanation of knowledge points, combine the derivation and application of specific concepts and theorems with the corresponding Chinese philosophical thoughts. For example, when explaining knowledge points such as limits, extreme values, derivatives and integrals, and the infinitesimal method, integrate the thoughts of "Tao follows nature", "Things turn into their opposites when they reach the extreme", "Yin-Yang complementarity" and "Tackling the difficult by starting with the easy" respectively, combining abstract mathematical concepts with profound philosophical wisdom to help students master knowledge points and comprehend philosophical literacy at the same time. On the other hand, introduce cases related to real life and professional applications, combining Chinese philosophical thoughts, Advanced Mathematics knowledge and practical scenarios. For example, when explaining definite integrals and the infinitesimal method, combine problems such as physical work done by variable forces, economic marginal benefits and family income and expenditure planning, and integrate the thoughts of "advancing step by step" and "the interdependence of being and non-being", making students feel the practicality of mathematical knowledge and philosophical wisdom, stimulating learning interest and improving learning well-being [5].

3.2. Innovating Teaching Methods and Creating an Immersive Teaching Atmosphere

Change the traditional "lecture-based" teaching method, draw on heuristic, discussion-based and problem-situational teaching methods, innovate teaching modes, create an immersive teaching atmosphere, guide students to take the initiative to explore and think actively, comprehend Chinese philosophical wisdom, improve self-cognition and gain learning well-being in the process of participating in teaching, which is also a key pathway to improve the teaching quality of Advanced Mathematics [4]. On the one hand, adopt heuristic teaching, and put forward questions related to philosophical thoughts and mathematical knowledge before explaining knowledge points, such as "Why does a function change in the opposite direction after reaching the extreme value? What philosophical thought does this reflect?" and "What connotation of 'Yin-Yang complementarity' does the reciprocal relationship between derivatives and integrals conform to?". Guide students to think actively and explore positively, interpret the inherent connection between philosophical thoughts and mathematical knowledge combined with their own learning experience, and break the passive teaching mode of "teachers teach and students listen". On the other hand, adopt discussion-based

teaching, set up learning groups, and let students discuss topics such as "How can Chinese philosophical thoughts help us alleviate the pressure of learning Advanced Mathematics", "How to use the thought of 'reflecting on oneself' to improve our own learning" and "How to practice the equality concept of 'On the Uniformity of All Things' in mathematical modeling", sharing their own learning experiences and insights. In the process of communication and interaction, students deepen their understanding of philosophical thoughts and mathematical knowledge, and at the same time improve their self-expression and cooperation abilities, gaining a sense of belonging and accomplishment.

3.3. Improving Teachers' Literacy and Strengthening Integrated Teaching Ability

The integration of Chinese Philosophy into Advanced Mathematics teaching puts forward higher requirements for teachers' comprehensive literacy. Teachers not only need to have solid professional knowledge of Advanced Mathematics, but also need to deeply understand the core thoughts of Chinese Philosophy, master the teaching methods and skills of their integration, and strengthen integrated teaching ability [1]. On the one hand, teachers should strengthen their own learning, study classical philosophical works such as Tao Te Ching and Zhuangzi in depth, systematically master the core thoughts in classic works, understand their contemporary educational value, and pay attention to research results related to mathematical culture and Curriculum Ideological and Political Education at the same time, drawing on advanced teaching experience [6], improving their own philosophical and humanistic literacy, and breaking the cognitive limitation of "valuing professionalism over humanities". On the other hand, teachers should strengthen teaching research, combine their own teaching practice, deeply explore the integration entry points between Chinese Philosophy and Advanced Mathematics, explore scientific and reasonable integrated teaching modes, optimize teaching plans, and improve the pertinence and effectiveness of integrated teaching.

3.4. Improving Teaching Guarantee and Promoting the Effective Implementation of Integration

The organic integration of Chinese Philosophy and Advanced Mathematics teaching requires the improvement of the relevant teaching guarantee system, breaking various obstacles in the integration process, and promoting the effective implementation and normalized development of integrated teaching [4]. On the one hand, schools should strengthen top-level design, incorporate the integration of Chinese Philosophy into Advanced Mathematics teaching into the teaching reform plan, clarify teaching goals and requirements, optimize the allocation of teaching resources, provide necessary funding and equipment support for integrated teaching, ensure the sufficient supply of resources such as multimedia teaching tools, philosophical classics and teaching case libraries, and lay a material foundation for the development of integrated teaching. On the other hand, universities should strengthen teaching management, arrange teaching hours reasonably, reserve a certain amount of time in Advanced Mathematics courses for the infiltration and interpretation of philosophical thoughts, avoiding the formalization of integrated teaching due to tight class hours; at the same time, combine the reform of curriculum evaluation standards, incorporate students' philosophical literacy, self-cognition and well-being experience into the evaluation scope, break the single evaluation mode of "valuing grades over literacy", and urge teachers to implement cultural education and literacy cultivation in place.

4. Conclusion

As a core basic course for science, engineering and economic management majors in universities, Advanced Mathematics not only undertakes the mission of knowledge imparting and thinking training, but also shoulders the responsibility of literacy cultivation and cultural inheritance. Organically integrating Chinese philosophical thoughts into Advanced Mathematics teaching is not only an important measure to respond to the concept of Curriculum Ideological and Political Education and promote the reform of Advanced Mathematics teaching, but also an effective pathway to inherit excellent traditional Chinese culture and cultivate students' humanistic literacy. In the future, it is still necessary to continuously explore the in-depth integration mode of the two, constantly optimize the integration strategy, improve the guarantee system, promote the normalized and systematic development of integrated teaching, make the Advanced Mathematics classroom have both knowledge depth and humanistic warmth, truly realize the teaching goal of "enlightening wisdom with mathematics and moistening the heart with philosophy", and help the all-round development of students and the contemporary inheritance of excellent traditional Chinese culture.

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