Journal of Applied Mathematics and Computation, 2024, 8(4), 332-336
https://www.hillpublisher.com/journals/JAMC/
ISSN Online: 2576-0653
ISSN Print: 2576-0645

Strategies for Cultivating Students' Awareness and Ability of Mathematical Applications in the Process of Advanced Mathematics Teaching

Tianlei Wang

Henan Light Industry Vocational College, Zhengzhou 450003, Henan, China.

How to cite this paper: Tianlei Wang. (2024) Strategies for Cultivating Students' Awareness and Ability of Mathematical Applications in the Process of Advanced Mathematics Teaching. *Journal of Applied Mathematics and Computation*, 8(4), 332-336.
DOI: 10.26855/jamc.2024.12.008

Received: November 25, 2024
Accepted: December 23, 2024
Published: January 21, 2025

***Corresponding author:** Tianlei Wang, Henan Light Industry Vocational College, Zhengzhou 450003, Henan, China.

Abstract

In recent years, with the rapid development of society and the continuous progress of science and technology, mathematics as the language of science and technology, its application value has become more and more prominent. In the stage of higher education, higher mathematics is not only an important course to train students' logical thinking ability, but also a tool for students to understand and solve practical problems. However, in the actual teaching process, students' application awareness and ability of mathematics knowledge are still insufficient, and there is a disconnect between theoretical learning and practical needs. How to cultivate students' consciousness and ability to apply mathematics effectively in higher mathematics teaching has become an urgent problem for educators at present. Based on the teaching practice and theory research, this paper discusses the effective strategies to cultivate students' applied mathematics consciousness and ability in higher mathematics teaching and provides a reference for related teaching reform.

Keywords

Higher mathematics; Application consciousness; Cultivation strategy

As an important position for the training of vocational and skilled talents, higher vocational education aims not only at imparting theoretical knowledge but also at improving students' practical ability and professional quality. As the basic course of higher vocational colleges, higher mathematics plays an important role in the cultivation of students' logical thinking ability, problem-solving ability, and vocational core quality. However, in practical teaching, higher mathematics courses are often separated from students' vocational needs because of their abstract and theoretical content, resulting in students' low interest in learning and lack of application consciousness. With the increasing demand for high-quality technical talents in modern society, the reform of higher mathematics teaching is imminent. How to combine the characteristics of higher vocational education, combine the teaching of mathematical knowledge with practical application, and cultivate students' mathematical application awareness and ability through teaching content optimization, introduction of practice cases and interdisciplinary integration has become the focus and difficulty of higher vocational mathematics teaching and research, as well as an important path to improve students' vocational competitiveness.

1. The significance of training students' applied mathematics consciousness and ability in higher mathematics teaching

In higher vocational education, it is of great significance to cultivate students' consciousness and ability of applied mathematics. As the basic tool of science and technology, higher mathematics is not only an important means for students to understand the world and solve practical problems but also the key to promoting the development of their logical thinking, analytical ability, and innovative ability. Through higher mathematics teaching, students can understand the practical value of mathematical knowledge in professional fields in the learning process, and enhance the ability to transform abstract theories into practical applications. In addition, cultivating mathematics application ability helps students improve their ability to model, analyze, and solve complex problems, so as to meet society's demand for high-quality skilled talents. The cultivation of this ability can also stimulate students' interest in learning, enhance their self-confidence, and lay a solid foundation for their future career development.

2. The difficulty of training students' applied mathematics consciousness and ability in higher mathematics teaching

2.1 Lack of connection between theory and practice

The content of higher mathematics courses is mainly abstract theory, and its knowledge system is rigorous and complex, but in teaching practice, the connection between theory and practice is often not close enough. This disconnection makes it difficult for students to understand the value of mathematical knowledge in practical problems, leading to lower interest in learning and poor learning effects. Many teachers lay emphasis on the derivation of knowledge points and the application of formulas in the teaching process but ignore how to combine mathematical knowledge with specific vocational skills or industry needs. Students lack application experience in real situations, unable to understand the role of mathematics in practical work, which not only weakens students' application consciousness but also limits the development of their innovative thinking [1]. The lack of a combination of theory and practice is also manifested as the single case of the course and the limitation of the teaching content, which makes it difficult to meet the learning needs of students of different majors and affects the improvement of their professional ability.

2.2 The problem situation design is single

In higher mathematics teaching, the design of problem situations is very important to cultivate students' application consciousness and ability. However, in many current teaching activities, the design of the problem situation is still relatively simple, lack of diversity and pertinence, it is difficult to stimulate students' learning interest and initiative. Most of the teaching cases are mainly based on traditional numerical calculation or formula application, and there are few comprehensive problem situations related to the actual industry background. Students often feel that the problem-solving has nothing to do with their actual needs [2]. In addition, the setting of situations is often not challenging and hierarchical, which cannot effectively promote the transition from shallow understanding to deep thinking. The singleness of problem situation design limits the cultivation of students' multi-dimensional understanding of mathematical knowledge and flexible application ability, and it is difficult to help them form holistic thinking to solve problems in professional situations.

2.3 The training in applied thinking is weak

Applied thinking in mathematics is a key ability for students to transform theoretical knowledge into practical solutions, but in higher mathematics teaching, applied thinking training is often not paid enough attention [3]. The traditional teaching mode pays more attention to the memorization of knowledge and the mastery of formulas but lacks the systematic cultivation of the ability of problem analysis, mathematical modeling, and comprehensive solutions. Students often show rigid thinking and lack of flexibility in practical application, and cannot effectively use mathematical tools and methods in the face of complex problems [4]. This lack of training is also reflected in the teaching evaluation, simple examination results cannot fully reflect the level of students' applied thinking, resulting in teachers and students ignoring the improvement of this ability. In the long run, the disconnect between students' mathematics learning and actual needs will be further aggravated, and the training of applied ability will become an insurmountable gap.

2.4 Lack of independent learning ability

Advanced mathematics learning requires students to have strong independent learning abilities and be able to actively explore mathematical knowledge and apply it to practical problems. However, in the current teaching mode, students' independent learning ability is relatively weak, mainly manifested as dependence on classroom teaching, lack of independent thinking, and active research consciousness. In the face of new mathematical concepts or complex problems, students are often accustomed to mechanical imitation or direct search for answers, rather than through independent exploration to understand the underlying principles and methods. This lack of ability not only affects students' learning effect but also limits their ability to continue learning in their career development. The lack of effective strategies to guide students to independent learning in teaching activities, such as the provision of personalized learning resources and the construction of learning platforms that combine online and offline, has further exacerbated the problem.

3. The training strategies of students' applied mathematics consciousness and ability in higher mathematics teaching

3.1 Strengthen practical connection and highlight application orientation

In the teaching of higher mathematics, teachers should pay attention to the combination of theoretical knowledge and practical problems, and help students understand the application value of mathematical knowledge by introducing real cases and practical tasks. Instructional design can focus on industry needs and combine mathematical content with specific career scenarios, such as fields such as engineering calculation, data analysis, or management decision-making, to demonstrate the role of mathematics in solving practical problems. At the same time, teachers can invite experts from enterprises to participate in curriculum development to enrich the practicability of teaching content and enhance students' adaptability to future career situations [5]. By strengthening practical connections, students will not only be able to consolidate theoretical knowledge but also establish a link between mathematical thinking and vocational ability in the process of problem-solving.

For example, in the course "Quadric Surfaces and Spatial Curves", teachers need to explain the basic classification of quadric surfaces and their geometric features, including ellipsoid, hyperboloid, paraboloid, etc., and describe the mathematical equations and graphic features of these surfaces with specific formulas. In order to strengthen the practical connection, teachers can explain the practical application of quadric surfaces through engineering cases, such as the focusing characteristics of paraboloids in antenna design, the stability design of hyperboloids in cooling towers, etc. When explaining the space curve, it should include the parametric equations and geometric meanings of common curves, such as the representation of spiral and conic curves in three-dimensional space, and show the application value of curves in combination with practical situations such as gear design in manufacturing industry and aviation trajectory planning [6]. In addition, 3D modeling software can be used for dynamic demonstration in the teaching process to help students intuitively understand the spatial structure of surfaces and curves, cultivate their spatial thinking ability, and guide students to apply mathematical theories to solve complex engineering problems by designing real problem tasks.

3.2 Optimize the situation design to stimulate the learning interest

In the teaching process, teachers should pay attention to the design of problem situations, so as to guide students to actively participate in the exploration and application of mathematical knowledge. Students' interest in learning and thirst for knowledge can be stimulated by setting problem situations with distinct levels and moderate challenges. In teaching, project-based learning and inquiry teaching methods can be used to decompose complex problems into multiple links, and gradually guide students to think and solve them. In addition, teachers can use multimedia technology to build virtual situations, so that students can experience the application of mathematics in practical problems [7]. By optimizing the situation design, students can feel the value of mathematics in specific problems, thus enhancing the motivation and effect of learning.

For example, in the course "Conditions for path-independent Curve Integrals in the Plane of Green's Formula", teachers need to start from the basic definition of curve integrals and explain its application in the plane region and the relationship between path-independent conditions. The course content can be developed around Green's formula, clarify its core idea of transforming curve integrals into area integrals and visually demonstrate the relationship between curves and regions through graphics. In order to optimize the situation design, teachers can set up practical problem scenarios, such as calculating the flow of liquid in an irregular pipe, and guide students to model the problem and understand the practical significance of curve integral in engineering. For path-independent conditions, teachers can introduce the problem of calculating the potential energy of an electric field to show how path independence can be verified by the irrotation of a gradient field and Green's formula. Visual tools are used to dynamically demonstrate the connection between regional and curvy integrals, as well as the impact of path changes on the integration results, to stimulate students' interest in exploring the logic behind mathematical knowledge, and to further deepen their understanding of the knowledge points through group discussions and open questions.

3.3 Pay attention to thinking training and cultivate problem-solving ability

In the teaching of higher mathematics, the training of students' applied thinking should be taken as an important goal. Teachers can help students master the transformation process from theory to practice through problem analysis, model construction, and detailed explanations of problem-solving steps. Open questions and comprehensive tasks can be added in teaching activities, and students can be encouraged to propose hypotheses, reason, and verify, so as to improve their ability to solve complex problems. In addition, teachers should pay attention to the expression of thinking logic in the process of solving problems, encourage them to share problem-solving ideas in group discussions or class presentations and promote mutual learning and thinking collision. This kind of training not only improves students' ability to understand problems but also exercises students' innovative consciousness and team spirit.

For example, in the course Power Series Expansion of Functions, teachers need to explain the basic definition of power series, convergence conditions, and specific methods of how to expand functions into power series. The course may focus on the Taylor series and McLaughlin series, analyze the expansion of functions at a certain point in detail, and explain power series expressions for common functions such as exponential, logarithmic, and trigonometric functions. In order to focus on thinking training, teachers can design open problems and ask students to deduce the expressions of other related functions from the power series form of known functions, so as to train the ability of logical deduction. By setting up multi-step computing tasks, such as verifying the convergence of series within a given interval or using power series to approximate complex function values, students can develop the ability to decompose problems and solve them step by step. In addition, teachers can guide students to explore the application of power series in numerical analysis and engineering calculation, such as using power series to approximate nonlinear equations in circuit analysis and stimulate their interest in actively exploring complex problems.

3.4 Enhance their self-awareness and build learning mechanisms

Teachers should cultivate students' awareness of independent learning through diversified teaching means, and build a learning mechanism that supports personalized development. Online learning platforms and diversified resources can be introduced into the curriculum design to encourage students to study and explore math problems independently in extracurricular time. By assigning open assignments or research projects, students' ability to actively consult information and find solutions can be cultivated. In addition, teachers should conduct regular guidance on learning methods to help students master the skills of time management and self-feedback so that they can constantly adjust and improve during the learning process. By building a good self-learning mechanism, students can not only improve their ability to apply mathematics but also form the habit of continuous learning in their future careers.

For example, in the course "Infinitesimal Method of Definite Integration", teachers need to explain the basic principle of the infinitesimal method, which is the idea of dividing a complex continuous problem into infinite tiny parts for integral accumulation. The content of the course can be introduced from typical problems in physics and engineering, such as calculating the area of an irregularly shaped area, the volume of an object in rotation, or the arc length of a curve by the infinitesimal method, to help students establish practical application scenarios of definite integrals. The teacher should focus on the analysis of the way in which the element is selected, the expression of the component, and the logical steps in establishing the integral expression. By designing hierarchical problems, such as solving the area of a simple geometric figure to the volume of a complex surface, students' modeling and problem-solving abilities are gradually improved. Practical tasks can be introduced into the class, such as calculating the amount of materials in manufacturing or parameter optimization in engineering design, to encourage students to analyze problems independently and build integral models, so as to strengthen their mathematical application awareness and comprehensive problem-solving ability.

4. Conclusion

To sum up, this paper mainly studies the cultivation strategies of students' applied mathematics consciousness and ability in higher mathematics teaching, from the aspects of strengthening practical connection, optimizing situation design, focusing on thinking training, and improving self-learning consciousness. Through the combination of theory and practice, it aims to improve students' understanding and application ability of mathematical knowledge and cultivate their comprehensive quality of solving practical problems. It is hoped that the research of this paper can provide useful ideas for the reform of higher mathematics teaching and play an active role in improving students' vocational competitiveness and innovation ability.

References

[1] Cheng JX. The effect of Physical Exercise on adolescents' psychological well-being: the mediating role of Social Self-efficacy. Sports Teachers and Friends. 2019;47(4):59-62.

[2] Zhu LH. The effect of physical exercise on adolescents' aggressive behavior: the mediating role of mindfulness. Guangxi: Guangxi Normal University; 2024.

[3] Han XM. Strategy analysis of Higher Mathematics Education to Cultivate Students' Mathematical Application Ability. Journal of Jiangxi Electric Power Vocational and Technical College. 2021;34(4):79-80.

[4] Ruan SP. Exploring the Reinforcement of Students' Mathematical Application Ability Cultivation in Advanced Mathematics Teaching. Journal of Wuhan Shipbuilding Technical College. 2021;20(3):89-91.

[5] Zhang QT. Research on Cultivating Students' Mathematical Application Ability in Higher Mathematics Teaching. Intelligence. 2020;(25):95-96.

[6] Julisa. Strategies for Cultivating Students' Application Ability in Advanced Mathematics Teaching for Vocational and Technical Teachers. Vocational and Technical Education. 2016;37(35):54-56.

[7] Mei FT. Research and Practice of Higher Mathematics Teaching Training Students' Mathematical Application Ability. Coal Mining. 2014;19(z1):521-522, 586.

[8] Hwang GJ, Tu YF. Roles and Research Trends of Artificial Intelligence in Mathematics Education: A Bibliometric Mapping Analysis and Systematic Review. Mathematics. 2021;9:584.