

# The Construction of a New System for University Mathematics Teaching Based on Ability Cultivation

Lifeng Guo\*

College of Information Engineering, Tarim University, Alar 843300, Xinjiang, China

*\*Author to whom correspondence should be addressed.*

**Copyright:** © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

**Abstract:** To meet the demands of higher education reform and innovative talent cultivation, the teaching team of Tarim University, with ability cultivation as the core, has established a new “331” university mathematics teaching system. Through the multi-dimensional linkage of master teachers’ guidance, course optimization, stratified teaching, practical reinforcement, and competition-driven, it has significantly improved students’ mathematical application ability and innovative quality.

**Keywords:** University mathematics; Teaching system; Ability cultivation

**Online publication:** July 31, 2025

## 1. Overview of achievements

### 1.1. Brief introduction of achievements

Over the past four years, in order to strengthen students’ mathematical foundation, broaden their mathematical horizons, enhance their mathematical practice and cultivate their mathematical application innovation ability, the teaching team, relying on the master teacher studio and with the construction of first-class courses as the core, has developed a brand-new university mathematics teaching system (the “331” teaching system). Three leading: Leading by the master teacher studio, leading by the first-class course, leading by the quality textbook; Three hierarchical curriculum system construction: Build a hierarchical (engineering, science, agriculture) and modular university mathematics curriculum system to meet the needs of students of different majors and at different levels. Ability development: The development of students’ innovation ability. This system effectively addresses the problems existing in college mathematics teaching by optimizing teaching content, innovating teaching models, strengthening practical links, laying the foundation of first-class courses, and compiling high-quality teaching materials (see **Figure 1**).

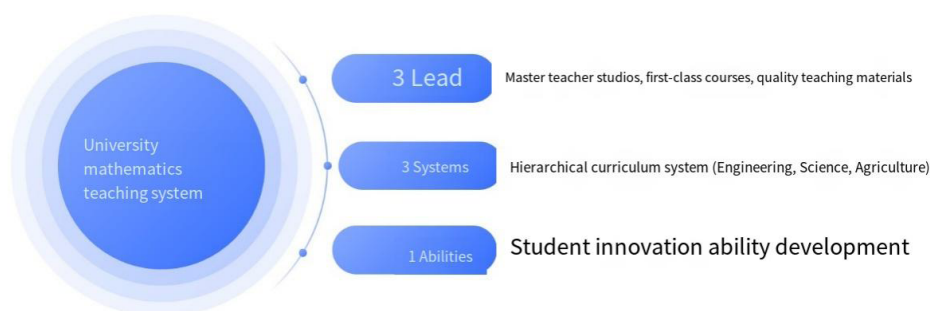


Figure 1. “331” teaching system

## 1.2. The main teaching problems addressed (Figure 2)

### 1.2.1. Master teacher studios lead the creation of quality teaching teams

Solve the problems<sup>[1-3]</sup> such as the lack of systematicity in the organization of university mathematics courses and the imperfection of the curriculum system through three aspects: the construction of master teacher teams, research on teaching reform, and teacher training and guidance.

**Team building of master teachers:** Establish master teacher studios composed of renowned mathematicians, teaching masters, and young backbone teachers to form a teaching echelon combining old, middle-aged, and young teachers. The teaching team consists of one leading talent in education under the “Tianshan Talent” program of Xinjiang Uygur Autonomous Region. In the past four years, one new professor and two associate professors have been added, and two have been promoted to master’s degree supervisors. One third prize of the Teaching Achievement award of Xinjiang Production and Construction Corps and two teaching achievement awards at the university level have been won.

**Teaching reform research:** The teaching team holds regular teaching seminars to discuss hot issues in mathematics teaching reform and propose innovative teaching strategies and methods<sup>[4-6]</sup>. Over the past four years, we have actively applied for teaching reform projects in the Corps, obtaining one demonstration team project of ideological and political education in courses in the Corps, one key project, and five general projects of teaching reform in Tarim University.

**Teacher training and guidance:** The teaching team trained and guided young teachers through forms such as demonstration class observation, teaching lecture exchange, and class observation and evaluation to improve the overall teaching level. We have guided young teachers to participate in various teaching competitions, winning one third prize in the National Young Teachers’ Teaching Competition, one first prize in the Xinjiang Production and Construction Corps Young Teachers’ Teaching Competition and one third prize in the Teachers’ Teaching Innovation Competition, one second prize and one third prize in the Tarim University Young Teachers’ Teaching Competition, and one second prize and one third prize in the Tarim University Teachers’ Teaching Innovation Competition.

### 1.2.2. Relying on the construction of first-class courses, promote the development of university-based resources for mathematics

The teaching team has applied for the establishment of five university-level first-class courses, namely Advanced Mathematics A1, Linear Algebra, Probability Theory and Mathematical Statistics, Mathematical Analysis, and Mathematical Modeling, and has built test banks for three courses, including Advanced Mathematics and Linear Algebra, providing high-quality educational resources for more than 8,000 students

and learners of the university each year. This has effectively improved the situation of incomplete school-based resources, uneven mathematical foundations of students, and difficulty in ensuring teaching effectiveness<sup>[7-9]</sup>.

### 1.2.3. Through the development of high-quality teaching materials, we have contributed to the construction of first-class courses

The teaching team has published four teaching materials, namely Advanced Mathematics, Linear Algebra, Probability Theory and Mathematical Statistics, and Mathematical Modeling and Mathematical Experiment, which are closely related to the actual situation of our students and focus on the cultivation of students' mathematical literacy and application ability. We have made considerable progress in teaching practice. The four textbooks have been adopted by more than 10 domestic universities, with a print run of over 100,000 copies. At the same time, they actively applied for planning textbooks, and three textbooks, including "Linear Algebra," were recommended for the 14th Five-Year Plan.

### 1.2.4. Optimizing the teaching process to enhance students' interest in learning

The teaching team, guided by the OBE (outcome-based education) concept in the teaching process, adopted various teaching methods and means, integrated ideological and political education in the curriculum, case teaching, mathematical modeling thinking, etc. into the classroom, and solved problems<sup>[10,11]</sup> such as the traditional and monotonous teaching methods, lack of innovation and practicality in the teaching process.

### 1.2.5. Guiding subject competitions to enhance students' innovation ability

Over the past four years, students have achieved outstanding results in various competitions, winning a total of 223 awards at the provincial level or above, including five second prizes at the national level and five special prizes at the provincial level in the National College Students' Mathematical Modeling Contest, one first prize at the national level and 16 second prizes at the provincial level in the National College Students' Statistical Modeling Contest.

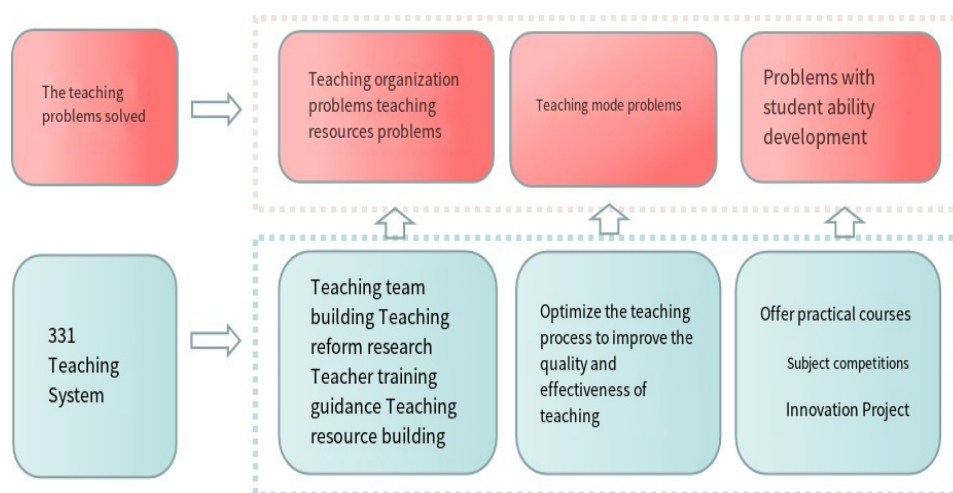


Figure 2. Teaching problems solved by the achievements

## 2. Construction and implementation path of the teaching system

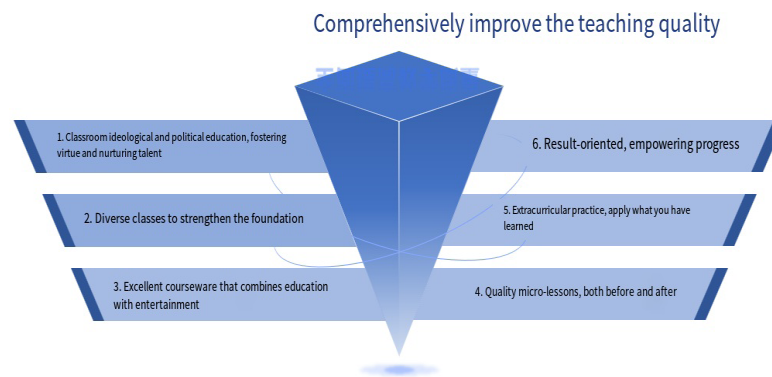
### 2.1. Leading by master teacher studios

The teaching team has established master teacher studios led by the teaching masters of the autonomous region,

gathering a group of outstanding mathematics teachers from Tarim University, Shihezi University, Xinjiang University, etc. Members of the studio regularly carry out activities such as teaching discussions, curriculum development, and teaching reform to jointly improve the level and quality of teaching. We have successively organized teaching activities such as public demonstration classes, teaching competition observation, MOOC westward journey course discussion, case sharing of ideological and political education in courses, and mathematical modeling discussion to build consensus on teaching and research and create a high-quality teaching and research platform for university mathematics.

## 2.2. Laying the foundation for first-class courses

The teaching team organized teachers to actively build first-class courses and successively initiated five first-class courses, including Linear Algebra, Probability Theory and Mathematical Statistics, Advanced Mathematics A1, Mathematical Analysis, and Mathematical Modeling. These courses are not only rich in content and of high quality, but also focus on practical application and the cultivation of innovative thinking. The guidance and demonstration of these first-class courses have greatly promoted the optimization and upgrading of the entire university mathematics teaching system in our university<sup>[12,13]</sup>. Based on the students' situation and the characteristics of the discipline and major, the teaching team has established a “four-in-one” teaching goal that focuses on basic knowledge, disciplinary collaboration, logical thinking, and value sentiment. With the overall improvement of teaching quality as the core objective, the “one core and six wings” teaching model of “diverse classrooms, excellent courseware, high-quality micro-lessons, ideological and political education in the classroom, subject competitions, and outcome-oriented” has been refined (see **Figure 3**).



**Figure 3.** “One Core and Six Wings” teaching model

## 2.3. Construction of a hierarchical curriculum system

Our university is a comprehensive institution with agriculture as its strength, life sciences as its specialty, and coordinated development of multiple disciplines including agriculture, science, engineering, medicine, literature, management, economics, law, education, art, and history. The teaching team divides the advanced mathematics course into three levels—Advanced Mathematics A, Advanced Mathematics B, and Advanced Mathematics C—based on the disciplines of engineering, economics and management, and agriculture, and adjusts the teaching content according to the needs of different majors. At the same time, flexible and diverse teaching methods are adopted, combining lectures, discussions, experiments, projects, and other teaching approaches to meet the learning needs of students of different levels and types.



## 2.4. Optimizing the teaching process

The teaching team focuses on the optimization and innovation of the teaching process, guided by the OBE teaching concept, adopts various teaching methods and means, based on the characteristics and teaching difficulties of mathematics courses, combines inside and outside the classroom, and integrates elements such as ideological and political education in the curriculum, case teaching, and teaching reform projects in the classroom. We have developed a teaching approach that combines “flipped classroom, case teaching, project-driven, and competition-driven learning.” At the same time, strengthen the cultivation of students’ practical links and enhance their mathematical application ability, innovation ability, and teamwork ability through subject competitions (such as mathematical modeling, college mathematics, statistical modeling, etc.). Based on digital teaching platforms such as “Rain Classroom” and “Learning Pass” and artificial intelligence technology, through the analysis of classroom data and online test data, a human-intelligence collaborative learning situation tracking is formed <sup>[14,15]</sup>.

## 2.5. Enhancing the innovative value of subject competitions

The teaching team innovatively conducts subject competitions to enhance their appeal, influence, and innovative value. Encourage interdisciplinary competitions in the organization process, such as “interdisciplinary competition teams” that combine multiple fields including computer science, statistics, mathematics, and physics; Select different competition topics based on the professional background of the participants to ensure that each individual can find innovative value that suits them; Carry out competition activities across schools and districts to enhance the teaching ability of the teaching team and the innovation ability of students. The overall results are shown in **Figure 4**.



**Figure 4.** Results of problem-solving methods

## 3. Promotion and application of achievements and effects

### 3.1. Promotion within the school

Our teaching results have been widely promoted and applied within the school. Through the leadership of master teacher studios and the demonstration effect of first-class courses, we have promoted the optimization and upgrading of the entire university mathematics teaching system. At the same time, we have strengthened cross-integration and collaborative innovation with other disciplines, providing students with a more comprehensive and diverse learning experience.

### **3.2. Off-campus influence**

Our teaching outcomes have also received high attention and recognition outside the school. We have been invited many times to present our experiences and practices at academic conferences and teaching seminars of universities in Xinjiang, and have received wide acclaim from experts and scholars attending the conferences. At the same time, we have also established partnerships with many universities to jointly promote the in-depth development of university mathematics teaching reform.

### **3.3. Social evaluation**

Our teaching achievements have been widely recognized and highly praised by all sectors of society. Students have achieved excellent results in competitions, winning more than 210 awards in national and provincial mathematics competitions. At the same time, our teaching achievements have received extensive attention and coverage from the media and the academic community, making positive contributions to the improvement of the school's reputation and influence.

### **3.4. Application effect**

Since the implementation of the project, students' innovation ability has been further enhanced, benefiting more than 30,000 students cumulatively. Students' practical and innovative abilities have been significantly improved, winning six national awards in subject competitions, over 210 awards at the provincial level and above, and guiding more than 30 innovation projects.

In 2020, the number of students participating in various college students' mathematical modeling competitions was 341, and in 2024, the number of students participating in various college students' mathematical modeling competitions increased to 537. In 2020, 52 people signed up for the National College Mathematics Contest, with 17 winners, and in 2024, 111 people signed up, with 28 winners. The number of major subject competition categories for students has expanded from five in 2020 to eleven in 2024.

## **4. Conclusion**

The construction of a new system for college mathematics teaching is an important practice in response to the demands of higher education reform and innovation for talent cultivation. The teaching team of Tarim University, with the "331" system at its core, has built a teaching ecosystem that is both scientific and practical through the leading power of master teacher studios, the supporting power of first-class courses, the adaptability of stratified teaching, the driving force of innovative models, and the traction of subject competitions. This system not only addresses the pain points of "weak foundation, uneven resources, single methods, and lack of practice" in traditional teaching, but also lays a solid foundation for students' professional growth and innovative development through the three-dimensional integration of "knowledge imparting–ability cultivation–value shaping."

Four years of practice have proved that the system has effectively enhanced students' mathematical application ability and innovation literacy, promoted the professional development of the teaching team, and formed a replicable and scalable reform model among regional colleges and universities. In the future, the teaching team will continue to deepen the "student-centered" educational philosophy, deepen the integration of industry and education and digital teaching reform, and make mathematics education an important engine for nurturing new era talents who are "solid in foundation, strong in practice, and bold in innovation," contributing more wisdom and strength to the high-quality development of higher education.

## Funding

Advanced Mathematics A1 First-Class Course of Tarim University (TDYLKC202428); Educational Reform Project of Xinjiang Production and Construction Corps (BTBKXM-2024-Y41)

## Disclosure statement

The author declares no conflict of interest.

## References

- [1] Li Y, Wang S, 2024, The Teaching Path of Mathematics in Colleges and Universities Based on the Cultivation of Applied Innovation Ability. *Science and Technology Wind*, 2024(27): 37–39.
- [2] Gao X, 2023, The Reform Path of College Mathematics Teaching Based on the Cultivation of Innovation Ability. *Educational Teaching Forum*, 2023(5): 70–73.
- [3] Wang J, 2025, Research on the Teaching System of Higher Vocational Mathematics Based on the Cultivation of Innovation Ability. *Science Consultation*, (01): 218–221.
- [4] Wang X, 2023, Teaching Strategies of Higher Vocational Mathematics Based on the Cultivation of Mathematical Modeling Ability. 2023(10): 133–135.
- [5] Bai Y, 2024, Research on Mathematics Teaching in Higher Vocational Colleges Based on the Cultivation of Application Ability. *New Curriculum Teaching (Electronic Edition)*, 2024(17): 170–172.
- [6] Zhu Z, 2023, Research and Practice on Teaching Reform of Higher Mathematics Based on the Cultivation of Students' Mathematical Application Ability. *New Curriculum Research*, 2023(30): 117–119.
- [7] Qin G, 2024, Research on the Construction and Practice Path of a New Form of Mathematical Modeling Teaching Empowered by Digitalization. *China Educational Technology Equipment*, 2024(24): 19–21.
- [8] Liu L, 2023, Construction of a Thinking Ability-Oriented Teaching System for Higher Vocational Mathematics. *New Curriculum Research*, 2023(33): 123–125.
- [9] Tang G, Liu S, Zeng X, et al., 2023, Research and Practice on Teaching Reform of University Mathematics from the Perspective of New Engineering. *Journal of Higher Education*, 9(2): 162–165.
- [10] Gong X, Wu R, 2023, Research and Practice on Teaching Reform of Higher Mathematics Courses in Local Application-Oriented Private Colleges. *Journal of Liaoning Communications College*, 25(1): 84–87.
- [11] Zhou J, 2023, Research on the Teaching System of Higher Vocational Mathematics Based on the Cultivation of Innovation Ability. *University (Teaching and Education)*, 2023(10): 93–96.
- [12] Yue H, 2023, Exploration of Teaching Reform of Higher Mathematics Based on the Cultivation of Thinking Ability. *Science and Education Guide*, 2023(20): 61–63.
- [13] Li X, 2023, Research on Cultivating Students' Innovative Consciousness in College Mathematics Teaching. *Electronic Journal of the New Era of Education (Teacher Edition)*, 2023: 145–147.
- [14] Gao R, Yang L, 2024, Construction of the Practical Teaching System for Mathematics and Applied Mathematics in Local Normal Universities. *Shanxi Youth*, 2024(18): 181–183.
- [15] Quan T, Zhang L, Zhang H, et al., 2023, Innovation and Practice of Teaching Mode of Advanced Mathematics in the Context of New Engineering. *Journal of Shenyang Agricultural University: Social Science Edition*, 25(1): 101–105.

### Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.