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The Exploration of Differential Teaching of Calculus in Financial and Economic Universities under the Innovation of Digital Economy

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ABSTRACT: Our paper concerns the practical strategy of calculus differentiation teaching in finance and economics universities. According to the characteristics and needs of students in finance and economics universities, the specific differentiated teaching strategy of calculus course is put forward, and the effect of differentiated teaching is analyzed through practical teaching. The article aims to provide reference for improving the teaching quality of calculus courses in finance and economics universities.

KEY WORDS: calculus; differentiated teaching; financial and economics universities

I. THE NECESSITY AND URGENCY OF CALCULUS DIFFERENTIATION TEACHING IN FINANCIAL AND ECONOMIC UNIVERSITIES UNDER THE INNOVATION OF DIGITAL ECONOMY

The current status and trend of economic development indicate that the digital economy has become an important engine driving economic growth around the world. The digital economy not only includes emerging technologies such as big data, cloud computing, Internet of Things, blockchain, artificial intelligence and 5G communications, but also covers new retail and new manufacturing. In essence, it is to realize the rapid optimization of the allocation and regeneration of resources through the identification, selection, filtering, storage and use of big data, so as to promote the high-quality development of the economy.

Recently, multiple departments including the Ministry of Industry and Information Technology and the Ministry of Education jointly released the "Action Plan for Accelerating the Cultivation of Digital Talents to Support the Development of the Digital Economy (2024-2026)", which aims to promote the implementation of the decisions and deployments of the Party Central Committee and the State Council on the development of the digital economy, give full play to the fundamental role of digital talents in supporting the digital economy, accelerate the formation of new quality productive forces, and empower high-quality development. In recent years, China has made remarkable achievements in the development of digital economy. The scale of digital economy has a high proportion of GDP, and China has made important breakthroughs in mobile payment, e-commerce, artificial intelligence and other fields. In the future, the development of digital economy will focus on the allocation of data elements, industrial digital transformation, and the speed of capital market circulation, so as to give full play to the important role of digital economy in boosting national economic growth and realizing common prosperity.

As we all know, mathematics plays a key basic role in cultivating intellectual talents in the era of information and digital economy. Under the background of the improvement of national digital literacy, calculus, as one of the basic mathematics courses, plays an important role in cultivating students' logical thinking ability, problem analysis and problem solving ability. Its teaching quality is directly related to the understanding and application of students' knowledge in the fields of economics, finance, statistics, information, etc, see e.g. [1]. Calculus is widely used and in-depth in the field of finance and economics. It plays an indispensable role in understanding market dynamics, building financial models, conducting risk management or optimizing investment decisions. Therefore, it is crucial for students and practitioners of finance and economics majors to master the knowledge of calculus.

However, with the expansion of the scale of higher education and the reform of the recruitment system, the gap between students' knowledge foundation, learning ability, and professional needs in finance and economics universities is becoming increasingly apparent, and the quality of students in local finance and economics universities varies greatly (See e.g.[2]); Focusing solely on students' academic performance in student stratification, neglecting in-depth analysis of students' learning motivation, psychological factors, and personality traits; Higher mathematics teaching is based on professional and administrative classes, neglecting the intrinsic connection between teaching content and the major being studied. The content of mathematics teaching materials is outdated, with more course content and fewer class hours. Classroom teaching focuses only on explaining basic concepts, proving theorems, deriving formulas, and calculating exercises, and cannot cater to students' different personalities and needs, e.g. [2,3]; The differentiated teaching system is not sound, lacking teaching guidance, assessment and evaluation systems that are compatible with differentiated teaching, making it difficult to ensure the orderly promotion of differentiated teaching. See e.g. [4]. Therefore, based on the teaching practice of calculus in our university, it is necessary to explore the strategic ideas for differentiated teaching of calculus in finance and economics universities, analyze its specific application and practical effects, and provide reference for the cultivation of digital economy talents in the entire finance and economics university.

II. THE THEORETICAL BASIS AND LEARNING BASIS OF DIFFERENTIATED TEACHING

The theoretical basis of differentiated teaching stems from the deep understanding and respect of students' individual differences in modern educational psychology. Modern educational psychology believes that every student is a unique individual, with differences in cognitive structure, learning style, interests and interests. These differences lead students to show different speed and effects when receiving knowledge and mastering skills. Therefore, differentiated teaching emphasizes the formulation of teaching plans and methods in line with the characteristics of students according to the individual differences of students in the teaching process, so as to meet the learning needs of different students.

In the implementation of differentiated teaching in calculus course, the theoretical basis mainly includes the following points. According to Howard Gardner's theory of multiple intelligence, each student has a variety of intelligence, such as language intelligence, mathematical logic intelligence, spatial intelligence, etc. In calculus teaching, teachers should realize that students may show advantages or disadvantages in different intelligent fields, and adjust their teaching strategies accordingly to stimulate students' interest and potential in learning. The theory of recent development zone proposed by Vygosky states that students have two levels of

development: the current level, the possible level of development, the potential gained through learning. Differentiated teaching requires teachers to set teaching objectives slightly higher than the current level on the basis of evaluating students 'current level, so as to stimulate students' learning motivation and potential. Of course, we know that different students show different learning styles in the learning process, such as visual, auditory, kinesthetic and so on. In calculus teaching, teachers should adopt diversified teaching methods and means according to students 'learning style to better meet students' learning needs. In addition, in terms of the characteristics of students in financial and economic universities, students are unique and quite different in terms of mathematics foundation, professional background and future career development direction. in this regard:

- **Students' professional background is different from their mathematical foundation:** Students in the calculus teaching class usually involve different majors, such as finance, accounting, economics, finance and taxation, art and design, etc. They have great differences on the basis of mathematics. Some students are science students, and some are liberal arts students. Some students may have been exposed to calculus knowledge in high school and have a certain mathematical foundation, while others may have a relatively weak mathematical foundation and have difficulties in understanding and application of calculus concepts.

- **Students in finance and economics colleges have different learning motives and their future career development needs :** Finance and economics students mainly hope to learn calculus, analyze market dynamics, build financial models, conduct risk management and optimize investment decisions, so as to lay a foundation for their future entry into banks, investment banks and securities companies. In terms of job prospects, the digital economy offers the possibilities for a lot of jobs. Whether it plays an important role in financial analysis, investment decision making, risk management, big data analysis, programming or macroeconomic research, higher mathematics plays an important role. However, different careers have different priorities or levels of demand for mathematics.

- **There are differences in the demand analysis of calculus courses of students in finance and economics colleges.** : Mathematics is a required basic course for economic management majors in our school, and it is also a necessary tool for learning the courses of various majors, which plays a very important role. Most students' demand for calculus is mainly reflected in the practical application. The combination of calculus knowledge with financial practice requires more practical cases in teaching. And some students need to further study, or prefer the direction of finance, so high mathematical requirements. In order to meet the needs of differentiated and personalized teaching of our students and improve the mathematics level of students of various majors in economic management in our school, mathematics grading teaching is tried out in the 2020 School of Finance, Business School and School of Accounting in our university. Therefore, students in finance and economics universities have different needs in terms of major, mathematics foundation and career development. Accordingly, as educators need to formulate teaching strategies in line with students 'reality to improve students' calculus, learning effect and application ability.

- **Differentiated teaching strategy of calculus in financial and economic universities:** According to the characteristics of financial and economic university students and the demand for calculus, it is particularly critical to implement the differentiated teaching strategy of calculus. In the calculus differentiation teaching practice, we can adopt the following some feasible teaching strategies.

- **Optimize the stratified teaching strategy to promote the hierarchy of teaching content and evaluation**

Colleges and universities should meet the needs of teaching reform and development, Reform and optimize the content of university mathematics courses[5,6], Building a differentiated teaching curriculum system, Teachers should have a deep understanding of the multi-level and multi-directional needs of students in groups, Fully considering many factors, such as academic performance, acceptance ability, personality characteristics, cooperation and communication ability, career development and so on, Scientific grouping of the students according to their individual differences, Some colleges of our school, Such as the School of Finance and Taxation, School of Economic Statistics and School of Information Management, By this way, Set up a similar experimental class, the top class, These classes are more math-demanding, The difficulty and capacity of the course are correspondingly relatively large, And most students are to take the postgraduate study. The rest of the ordinary class students' calculus teaching is routine and more focused on application. Teaching objectives and training modes of different levels are formulated according to the situation, and different teaching objectives, teaching contents and teaching progress are set. Students are encouraged to participate in the breadth and depth of mathematics and intensive classes, to introduce modern mathematical knowledge such as nonlinear, randomness and ambiguity, to provide differentiated teaching guidance to students to ensure the basic mathematical knowledge and ability required by majors; to pay attention to professional research and teaching content, to open economic mathematics, biological mathematics, social science calculus, liberal science mathematics and other subjects, to guide students to combine their own professional characteristics and career prospects, so as to stimulate students' superior potential and fully improve the teaching efficiency.

- **Introduce project-based learning and establish group cooperative learning :** Through the form of group cooperation, the students can conduct research around a specific financial project, and use calculus knowledge to solve practical problems, which can cultivate the students' teamwork ability and innovative spirit. In fact, there are various academic societies in the school, such as mathematics competition, mathematical modeling, entrepreneurship and innovation, postgraduate entrance examination remedial classes and other groups, which can be further integrated with mathematics for further development. Teachers can assign calculus application problems related to the field of finance, let students discuss and study in groups, solve practical problems through cooperation, and cultivate students' teamwork ability and innovative thinking. By participating in national activities such as national Mathematics competition, mathematical modeling competition, financial and economic big data modeling competition, we can stimulate students' learning motivation and potential. Students are encouraged to participate in academic competitions or practical activities in the field of finance, such as simulated stock market investment, financial analysis, etc., to improve their practical application ability. Invite experts or practitioners in the financial industry to give lectures or sharing meetings, so that students can understand the wide use of calculus in practical work.

- **Integrating into financial cases to enhance students' interest in learning :** Interest is the best teacher, and many students are afraid to math courses and afraid of difficulties. Therefore, if they can improve their learning attitude and interest, calculus teaching will naturally get twice the result with half the effort. From the students learned related professional practical problems of mathematical concepts, such as when the limit can introduce the calculation formula of compound, starting from our deposits, loans, combined with the time value of money, by calculating the final value, compound, cumulative present value, finally guide students to understand the concept and application of limit. In portfolio optimization case, for example, through the calculus derivative part can introduce economic optimization problem, increase function and derivative in the economic

application, such as cost, income, profit, margin, elasticity, economics in the pareto optimization method, help students to understand how to allocate different assets in order to achieve the optimal risk and return balance. In the analysis of demand elasticity, the concept of derivative is used to analyze the impact of commodity price changes on the demand, so as to help enterprises to develop reasonable pricing strategies. In the case of cost and benefit analysis, the total cost and total benefit of the enterprise are analyzed through integral calculation to provide data support for the decision of the enterprise. By introducing more practical cases related to finance and economics, it can not only help students understand the application of calculus in the field of finance and economics, but also stimulate their interest and motivation in learning. At the same time, this teaching method also helps to cultivate students' practical application ability and innovative thinking, and lay a solid foundation for their future career development.

- **Diversified teaching methods are adopted to optimize the learning effect of different student groups**

Multimedia teaching, interactive teaching, case teaching and other teaching methods are used to stimulate students' learning interest and initiative. In the teaching of calculus in finance and economics universities, the innovation of teaching methods is very important to improving students' learning effect and interest. By means of information technology, online platforms, multimedia resources, MOOK and other modern teaching means, to provide students with a rich and variety of learning resources and interactive learning environment, such as online testing, simulation experiments, etc., can increase students' participation and stimulate their interest in learning. Intuitive teaching methods such as graphics and animations are used to help students understand abstract calculus concepts, such as showing the changing trend of functions through dynamic charts, or demonstrating the application of calculus in financial decisions through simulation experiments. Multimedia can integrate various teaching resources, dynamically display practical application cases in the field of finance and economics, and provide a large number of learning materials to enrich students' knowledge vision.

- **Design differentiated operations and establish a timely feedback mechanism:** Design differentiated assignments according to students' needs and interests. The assignment can include the consolidation of theoretical knowledge, the answers, and the analysis of financial cases. Through a variety of homework forms and content, to meet the learning to word problems needs of different students, so that students can consolidate the knowledge learned in the process of completing the homework, and improve the ability of solving problems. Validation experiment, computational experiment and exploratory experiment of calculus are introduced to enable students to deepen their understanding of the concept of calculus through practical operation. In combination with finance and economics courses, interdisciplinary practical activities are designed, such as simulated stock market investment, enterprise cost and benefit analysis, etc., so that students can use calculus knowledge in practice.

In order to improve the effect of differentiated teaching, it is necessary to establish a feedback mechanism, to collect students 'learning feedback regularly, and to timely understand students' learning situation and changes in their needs. Teaching strategies and methods should be adjusted according to the feedback of students, and teaching content should be continuously updated to ensure that they are closely combined with the needs of the industry, and that teaching activities are always carried out around the actual needs of students. At the same time, through the feedback mechanism, students are encouraged to actively participate in the teaching process to improve the learning effect and satisfaction. Build a diversified evaluation system, establish a diversified evaluation system oriented by application ability, and pay attention to the organic combination of process

Evaluation and result evaluation. In classroom evaluation, teachers should also make full use of differentiated teaching modes and adopt different evaluation criteria and methods with different situations of students as reference. Through the above practical strategies, the differentiated teaching of calculus can effectively improve students 'learning interest and enthusiasm in financial and economics universities, promote students' personalized development, and meet the actual needs of calculus application ability in the field of finance and economics. Through specific teaching cases, the practical effect of calculus differentiation teaching in finance and economics universities is analyzed. The students' academic performance, learning interest, learning attitude and other aspects are evaluated to verify the effectiveness of differentiated teaching strategies.

III. CONCLUSION

The key to improve the teaching quality of calculus in financial and economics universities is to emphasize students as the center and to the cultivation of students' practical application ability. Through the implementation of case teaching, project learning, the use of information technology and establish feedback mechanism, make calculus differentiation teaching strategy in finance and universities has achieved remarkable practice effect, not only improve the students 'calculus performance, also significantly improve the students' calculus application ability, stimulated the students' interest in learning and enthusiasm. From the perspective of the fit between teaching strategies and students' needs, by combining the knowledge of calculus with the actual needs of the field of finance and economics, implementing differentiated teaching strategies such as stratified teaching, group cooperative learning, and integration into financial cases, it effectively meets the personalized learning needs of students in finance and economics and promotes the all-round development of students. In terms of the continuous improvement of the teaching effect, the differentiated teaching strategy has achieved remarkable results, but it still needs to be continuously optimized and improved. In the future, the calculus teaching reform in finance and economics universities should continue to deepen the exploration and practice of differentiated teaching strategies, constantly promote the improvement and development of calculus teaching quality, and strive to cultivate more financial talents with calculus application ability.

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