# Course Reform and Practice of Quantitative Analysis in Behavioral Finance Based on Big Data and Artificial Intelligence

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***Abstract:*** *This study focuses on the innovative application of data science and artificial intelligence technologies in behavioral finance courses. By dissecting the limitations of traditional courses in the quantitative analysis training section, it proposes a teaching framework that integrates natural language processing, machine learning, and agent simulation technologies. The study designed a complete teaching process from data collection, feature engineering, model construction to simulation verification, and based on the real scenarios of the Chinese securities market, constructed a three-level progressive teaching program. After several rounds of empirical teaching tests, the curriculum framework has effectively enhanced students' quantitative research ability and critical thinking literacy, provided an innovative solution for cultivating compound financial talents in the digital age, and the research results have positive significance for promoting the innovative development of the financial discipline and the cultivation of interdisciplinary talents.*

***Keywords:*** *Behavioral Finance; Quantitative analysis; Curriculum reform; Artificial Intelligence*

## 1. Background and Theoretical Basis of Curriculum Reform

In the context of deepening financial innovation, behavioral finance, as a theoretical system for analyzing market anomalies, urgently needs innovative breakthroughs in its teaching model. The traditional curriculum focuses on theoretical interpretation and case analysis, and has obvious shortcomings in the training of quantitative research methods. This teaching model neither meets the professional requirements of modern financial institutions for data analysis talents nor enables students to truly master the empirical research methodology of behavioral finance. The reform and innovation of the teaching system in finance, driven by the digital wave, has become an inevitable trend.

The current behavioral finance curriculum is facing multiple development predicaments. From the perspective of knowledge transmission, there is a significant gap between the current curriculum content and the practical demands of the industry. Students can understand the basic theoretical framework, but lack the ability to apply modern data analysis techniques to solve practical problems. This disconnection between knowledge and practice directly affects students' career development potential. From the perspective of teaching methods, one-way indoctrination still dominates, making it difficult for students to form concrete perceptions of behavioral biases. From the perspective of practical teaching, existing teaching activities mostly remain at the level of simple case analysis and are unable to reproduce the complex dynamic processes of the real financial market. These problems have severely restricted the cultivation of students' quantitative research ability and innovative thinking.

The theoretical foundation of innovation in this course is mainly derived from three important theoretical systems. Constructivist learning theory emphasizes that knowledge is gradually constructed in the process of subject-object interaction, which provides theoretical support for project-based teaching. Experiential learning theory advocates creating knowledge through the transformation of experience, which provides a direction for designing immersive learning experiences. The computational finance research paradigm provides methodological guidance for the integration of modern information technology and finance teaching. These theories together form the theoretical basis for the innovation of this course.

In the current era of intelligent technology, big data and artificial intelligence technologies have opened up new paths for behavioral finance course innovation. Natural language processing technology makes it possible to extract market sentiment from massive network information, machine learning

methods provide effective means for constructing complex behavior prediction models, and multi-agent simulation technology creates experimental conditions for studying micro-market behavior. The mature application of these technologies provides a technical guarantee for innovative teaching methods in behavioral finance[1-3].

Based on the above background analysis, we carried out systematic curriculum innovation practices, focusing on promoting the deep integration of big data and artificial intelligence technologies with the teaching of behavioral finance. The innovation aims to build a new teaching model centered on data-driven and oriented towards ability cultivation, and to cultivate compound talents with both financial theoretical literacy and data analysis skills. This innovation involves not only the improvement of teaching methods, but also the overall reconstruction of the financial talent cultivation system.

## 2. Design and Construction of the curriculum system

On the premise of fully demonstrating the necessity of curriculum innovation, we systematically planned a new framework for the quantitative research course in behavioral finance. The curriculum system aims to cultivate students' quantitative analysis ability and is based on modern information technology. Through a three-level progressive teaching arrangement, it aims to achieve systematic cultivation from basic skills to comprehensive innovation ability.

The first level focuses on training in data acquisition and processing skills. At this stage, students need to have a comprehensive grasp of the basic characteristics and processing methods of big data in financial markets. Through real cases, the course instructs students to use web crawler technology to learn how to obtain financial information from unstructured data sources such as financial news and social platforms. Most importantly, students need to apply natural language processing methods to construct market sentiment indicators, a process that exercises both programming skills and the ability to extract value from complex information. Through this level of systematic training, students are able to develop a complete data thinking pattern, laying a solid foundation for subsequent quantitative research.

The second level focuses on the systematic development of model-building capabilities. Teaching at this level covers the entire process from feature extraction to model evaluation. In the feature engineering section, students need to learn how to extract valuable feature variables from raw financial data, a step that directly affects the performance of subsequent models. In the model selection phase, the course instructs students to select appropriate machine learning algorithms based on the characteristics of the specific problem, including different paradigms such as supervised learning and non-autonomous learning. In the model training and evaluation phase, students need to master key techniques such as parameter optimization and model validation through practice. Through this level of training, students not only understand the principles of various machine learning algorithms, but more importantly, develop the ability to construct applicable models for real-world problems.

The third level focuses on enhancing the ability to design and verify experiments. At this level, we developed a multi-agent-based financial market simulation platform to create an experimental environment close to reality for students. Students were required to design virtual investors with differentiated behavioral characteristics to simulate the trading mechanisms and information transmission processes of real markets. By adjusting the experimental parameters and observing the impact of different behavioral biases on the market, students can intuitively grasp the core theories of behavioral finance. This simulation experiment not only deepened students' understanding of the theory, but more importantly, it cultivated their scientific research innovation ability and systems thinking ability.

To ensure the smooth progress of the curriculum innovation, we have built a complete teaching resource system. First, we established A case library covering ten years of trading data in China's A-share market, all of which are derived from real market environments and have significant teaching value. Secondly, a computational experiment platform integrating multiple machine learning algorithms was developed, which offers a user-friendly interface and rich functional modules. Finally, a multi-agent simulation system capable of simulating the microstructure of the market was constructed, which can flexibly configure various market parameters to meet the experimental requirements at different levels. These teaching resources together form an important support for the implementation of the curriculum.

In terms of teaching methods, we have innovatively adopted a project-led teaching model. Divide the course content into multiple practical projects and require students to complete the entire process from data collection to model construction in teams. For example, "A Study on the Correlation between Market Sentiment and Stock Price Volatility Based on Social Platform Data" is a typical semester project. Through this complete research training, students not only master technical methods, but also develop teamwork awareness and project management skills. This teaching model breaks through the disciplinary boundaries of traditional courses and promotes the integration and innovation of knowledge.

## 3. Innovation in the Teaching Implementation Process and Methods

Based on the curriculum planning, we translate innovative ideas into concrete teaching actions through systematic teaching implementation. The teaching practice process emphasizes the connection between theory and practice, highlights the student's dominant position, and ensures the achievement of the curriculum objectives through diverse teaching method innovations.

At the teaching organization level, we adopt a combination of theoretical instruction and practical training. Each teaching module consists of two parts: theoretical analysis and experimental operation. The theoretical analysis focuses on explaining the principles and application scenarios of the method, while the experimental operation focuses on developing students' hands-on ability. For example, when explaining natural language processing techniques, not only the basic principles of text analysis are introduced, but also students are guided to actually write code to construct sentiment indicators. This combination of learning and application significantly enhances learning efficiency.

The curriculum advancement places particular emphasis on the progressive path of ability development. In the early stages of teaching, through exemplary cases and standardized codes, help students quickly master the basic operation methods. As the course progresses, gradually increase the openness and challenge of tasks to encourage students to explore solutions on their own. In the later stages of the course, students need to independently complete the entire process from problem discovery to solution design. This progressive teaching arrangement ensures learning outcomes while fostering students' innovative qualities.

In the teaching process, we attach particular importance to the creation of real-life situations. All teaching cases are based on real problems in China's financial market, such as the impact of online forum sentiment on stock prices and analysis of institutional investors' holding behavior. These real cases not only enhance the interest of learning, but more importantly, help students establish a connection between theory and practice. By analyzing real market data, students can gain a deeper understanding of the practical value of behavioral finance theory.

To enhance teaching effectiveness, we have developed a series of new teaching methods. Among them, the problem-based learning model has achieved remarkable results. Teachers pose challenging practical questions and students seek solutions through teamwork. In this process, students need to independently review literature, collect data, and build models, while teachers act as facilitators and mentors. This approach effectively mobilizes students' initiative and creativity in learning[4-6].

Another important teaching innovation was the introduction of a dynamic assessment mechanism. Traditional summative assessment has been replaced by process-oriented assessment, where teachers provide timely feedback and guidance by continuously tracking the progress of students' projects. The assessment focuses not only on the final outcome but also on the normativity and innovativeness of the research process. This approach has contributed more effectively to the development of students' abilities.

In terms of building teaching resources, we have developed a diversified support system. In addition to the basic teaching platform and case library, we have also established an online learning community to facilitate knowledge sharing and experience exchange among students. Industry experts are regularly invited to hold special topic discussions to help students stay informed about the latest developments in the industry. These measures have effectively expanded the learning space for students and created a richer learning experience.

During the implementation of the curriculum, we paid particular attention to individual differences among students. By setting up tasks at different levels, we meet the learning needs of students with different foundations. For students with a better foundation, offer more challenging research topics; For students with a weaker foundation, additional tutoring and practice are provided to help them keep up

with the teaching progress. This differentiated teaching strategy ensures that each student can achieve maximum development on their existing foundation.

To ensure the quality of teaching, we have established a continuous optimization mechanism. We adjust teaching content and methods in a timely manner through regular teaching evaluations and student feedback. For example, based on students' suggestions, more practical cases from the Chinese market were added and basic programming training was strengthened. This dynamic refinement mechanism ensures the advancement of the course content and the effectiveness of the teaching methods.

## 4. Teaching Outcomes and Future Development

The curriculum reform has achieved remarkable results after two rounds of complete teaching practice. Through a systematic assessment of the teaching process and results, it is clear to see the outstanding effect of the new teaching model in cultivating students' quantitative analysis ability and innovative thinking.

Based on the results of the quantitative assessment, students' comprehensive abilities have been comprehensively enhanced. By comparing the ability test results before and after the course, it was found that students' average score in financial data processing increased by 45 percent, model-building ability increased by 40 percent, and experimental design ability increased by 38 percent. These figures fully demonstrate the effectiveness of the new curriculum system in terms of ability development. More importantly, the problem analysis and innovative thinking demonstrated by students in project reports have also significantly improved, indicating that the curriculum reform has not only enhanced students' skill levels but also promoted the development of their comprehensive qualities.

In terms of concrete achievements, students have completed a large number of high-quality research projects. In two rounds of teaching practice, a total of 35 complete behavioral finance quantitative analysis reports, 18 machine learning-based behavioral prediction models, and 12 multi-agent simulation experiment designs were produced. Five of the research results won awards in the university-level academic competition, and three papers were included in the college proceedings. These achievements not only reflect the students' learning outcomes, but also demonstrate the innovative value of the new teaching model.

The results of the course satisfaction survey show that the new teaching model has been widely recognized by students. Ninety-four percent of students believe the course has effectively enhanced their quantitative analysis skills, ninety-one percent say they have gained a deeper understanding of behavioral finance theory, and eighty-nine percent think the course has cultivated their critical thinking. These figures confirm the success of the curriculum reform from the perspective of students. Notably, many students have reported that this practice-oriented teaching approach has sparked their interest in learning and changed their traditional perception of the finance curriculum[7].

The main innovative value of this curriculum reform is reflected in multiple dimensions. First, a complete teaching system for behavioral finance quantitative analysis has been established, filling the gap in the training of quantitative analysis methods in traditional courses. Secondly, the deep integration of modern information technology and finance teaching has been successfully achieved, providing a model for the reform of financial education in the digital age. Again, practical platforms that are close to the real research environment have been created, allowing students to be exposed to cutting-edge research methods during their school years. Finally, an innovative project-driven teaching model was adopted to effectively cultivate students' practical abilities and innovative spirit.

However, some challenges are also faced during the implementation of the course. The continuous update of teaching resources requires a lot of effort, especially in the context of rapidly changing financial markets, where case libraries and experimental platforms need to be constantly maintained and upgraded. The construction of interdisciplinary teaching staff is also an important issue, and there is a relative scarcity of compound teachers who understand both financial theory and information technology. In addition, the optimization of the teaching evaluation system still needs to be explored, and further research is needed on how to scientifically assess students' innovation ability and comprehensive quality.

Looking ahead, we will continue to promote curriculum development in the following aspects. First, we will deepen industry-education integration, strengthen cooperation with financial institutions, introduce more real projects and industry data, and enhance the practicality of the curriculum. Secondly,

expand international cooperation, draw on the successful experiences of top foreign universities, and continuously enhance the international perspective of the curriculum. Again, enhance teacher training through interdisciplinary training and team building to improve teachers' teaching skills. Finally, improve the curriculum system and develop more advanced courses to meet students' continuous learning needs[8].

The experience of this curriculum innovation is of great significance for promotion. The core ideas and teaching methods are not only applicable to the behavioral finance course, but can also provide a reference for the construction of other finance professional courses. Especially in the digital economy era, this teaching model that integrates modern information technology represents the direction of financial education. We are convinced that with the deepening of curriculum innovation, this innovative teaching model will play an increasingly important role in cultivating compound financial talents.

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