The Application of Digital Transformation in Financial Engineering Education: Innovative Exploration of Teaching Models and Learning Outcomes

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Abstract. This paper explores the digital teaching model reform of financial engineering courses supported by a big data platform, aiming to enhance students' self-directed learning abilities and practical skills. The study first analyzes the disconnect between theory and practice in traditional financial engineering teaching models and proposes educational innovation through the introduction of digital teaching methods such as the big data platform, Blended Learning, and Flipped Classroom. The platform provides rich learning resources, virtual laboratories, and real-time market data, enabling students to engage in practical exercises within a simulated environment and deepening their understanding of market fluctuations and risk management. Through teaching evaluations and data analysis, the study finds that classroom engagement and platform usage frequency are key factors influencing student learning outcomes. The research summarizes the effectiveness of the platform in improving teaching quality and outlines future directions and challenges for further development of the digital teaching models.

Keywords: Big Data Platform, Financial Engineering, Digital Teaching, Self-Directed Learning.

1 Introduction

The rapid development and increasing complexity of financial markets have led to stricter demands for professionals in the finance sector, particularly in areas such as risk management, derivative pricing, and portfolio optimization, which are core aspects of financial engineering[1]. Financial engineering, as a highly technical and quantitative discipline, traditionally focuses on training students to apply mathematical models, computational techniques, and statistical methods to solve complex financial problems [2]. However, conventional educational approaches tend to emphasize theoretical knowledge and quantitative analysis while neglecting the practical skills required to

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navigate real-world financial markets[3]. As a result, there exists a significant disconnect between academic training and industry demands, leaving graduates ill-prepared to tackle the complexities of modern financial environments[4]. This gap in financial engineering education is increasingly evident as financial markets become more dynamic and data-driven. Graduates often lack hands-on experience with the tools and technologies required for effective decision-making in volatile markets[5]. Traditional classroom teaching methods, which rely heavily on static lectures and paper-based assignments, do not adequately equip students to handle the fast-paced and unpredictable nature of financial markets. This disconnect between theory and practice underscores the need for educational reform. Recent advancements in digital technologies offer an opportunity to address these challenges. Tools such as big data platforms, virtual laboratories, data analysis software, and AI-driven teaching systems provide more interactive and practical learning experiences [6]. These technologies allow students to engage with real-time data and market simulations, developing practical skills alongside theoretical understanding. For example, virtual trading platforms can immerse students in simulated financial environments, enhancing their ability to analyze market fluctuations and manage financial risks

Despite the potential of digital tools in enhancing financial engineering education, their implementation remains underexplored, particularly in integrating theoretical learning with hands-on experience. Moreover, educational institutions face challenges such as the need for robust technological infrastructure, the high cost of platform maintenance, and varying levels of student adaptability to digital learning environments. Thus, there is a pressing need to investigate how digital transformation can effectively bridge the gap between academic instruction and industry practice in financial engineering education. This paper aims to explore the application of digital transformation in financial engineering education by introducing innovative teaching models that leverage digital tools such as big data platforms, blended learning, and flipped classrooms. Specifically, it examines how these models can enhance students' self-directed learning abilities and practical skills, preparing them for the challenges of real-world financial markets

2 Innovative Design of the Digital Teaching Model

The teaching reform of financial engineering courses is being driven by the digitalization wave, with traditional lecture-based approaches and paper-based assignments gradually being replaced by digital teaching models that integrate modern technology. In response to this educational transformation, the author’s university has actively embraced this trend by acquiring a big data application teaching platform and incorporating it into the financial engineering curriculum. The goal is to enhance the practical, interactive, and technical aspects of the course, providing students with a richer learning experience. This paper will explore the practical application of this platform and analyze its specific role and effectiveness within the teaching model.

With the introduction of the big data application platform, the teaching model for financial engineering courses has been innovatively redesigned, incorporating various

digital teaching methods to enhance students' learning outcomes. Firstly, the course adopts a Blended Learning model, combining online and offline instruction. In traditional classroom settings, instructors use the platform to provide students with rich pre-class learning materials, including datasets, financial analysis reports, and online video tutorials. Students can leverage these resources for self-study and data preprocessing, while post-class activities involve completing data analysis and model computations through the online system. This platform allows students to access learning materials at their convenience, enabling them to adjust their learning pace according to their own progress, thereby improving learning efficiency. Secondly, the course implements the Flipped Classroom teaching approach. In this model, the delivery of theoretical knowledge is no longer confined to classroom lectures. Instead, students engage with the theoretical content via online learning modules provided by the platform before attending class. Classroom time is then devoted to discussing real-world problems and conducting hands-on data analysis. For instance, during class, instructors can design financial case studies, allowing students to access real-time market data through the big data platform and collaborate in groups to analyze market fluctuations and propose solutions. This interactive classroom model increases student engagement and improves their practical skills, while solving real-world problems reinforces their understanding of theoretical concepts. Additionally, the platform's Virtual Lab feature significantly enriches the practical learning experience. Students can simulate various market scenarios within the virtual lab, design and test financial products, and even configure different market conditions and assumptions to explore how financial models perform under extreme circumstances, such as financial crises or market bubbles. Through these simulations, students gain valuable practical experience in a risk-free environment, allowing them to fully grasp the importance of managing uncertainty and risk in financial markets.

3 Teaching Evaluation and Student Feedback

To assess the actual impact of the big data application platform on the financial engineering course, the university conducted a comprehensive teaching evaluation, covering multiple aspects such as student performance, learning behavior data, and student feedback surveys. In order to better understand the influence of the digital teaching model on student learning outcomes, this study applied decision tree analysis to analyze and interpret the collected data, as shown in Fig 1. During the evaluation process, the research team collected data across various dimensions, including student engagement in the course, such as time spent learning, the number of times they processed data, and assignment completion. Additionally, data were gathered on students' platform usage frequency and feedback, including ease of use and the richness of learning resources, as well as final learning performance, such as midterm exams, final exams, and practical project scores.

Through decision tree analysis, we were able to identify the key factors that influenced student performance. The results showed that the primary factor affecting students' final grades was classroom engagement. For students with low engagement, the

number of online experiments became an important differentiator in their performance. Those who performed fewer online experiments generally achieved "average" results, while students who frequently used the big data platform performed well in the final exam, achieving higher grades. On the other hand, for students with high classroom engagement, platform usage frequency emerged as the main factor influencing their performance. Students who used the big data platform more frequently (platform usage frequency > 2.5) exhibited better academic performance, while those with lower usage frequency were further divided based on their ratings of platform ease of use. The analysis revealed that students who rated the platform as less user-friendly tended to achieve poorer results, whereas those who found the platform easier to use performed better.

This teaching evaluation demonstrates that students' classroom engagement and active use of the digital platform significantly impacted their academic performance. In courses like financial engineering, which emphasize practical application and data usage, digital tools play a critical role in enhancing learning outcomes.

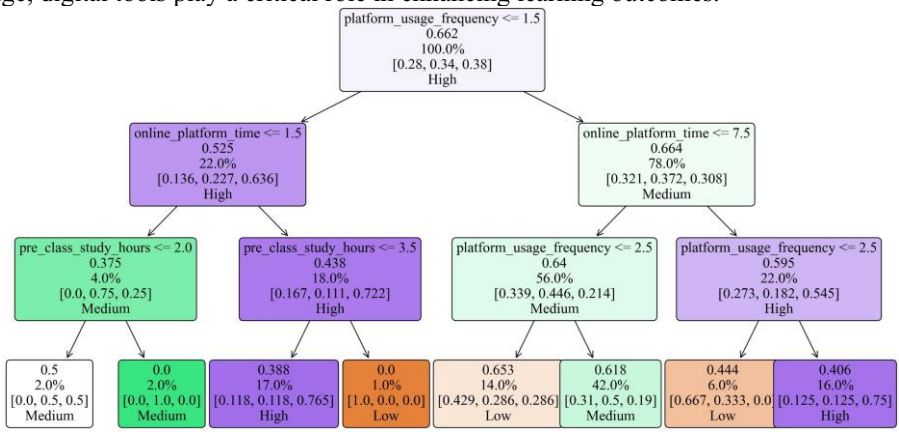

Fig. 1. Decision trees of the evaluation results.

4 Continuous Improvement and Future Outlook

he introduction of a big data application platform has significantly enhanced the quality of teaching in financial engineering courses, allowing students to gain hands-on experience in real-world data environments and effectively improving their analytical and practical skills. However, there are still areas that require improvement as the platform becomes an integral part of the educational process. First, the long-term maintenance of technical support and resources presents a critical challenge. The platform requires frequent updates to keep up with rapid technological advancements, as well as real-time data integration and security, which places high demands on the technical infrastructure of educational institutions. Achieving this goal necessitates a stable, long-term partnership between educational institutions and technology providers, allowing both parties to share the burden of updates and data integration to ensure the platform consistently delivers high-quality services. Furthermore, managing the ongoing maintenance costs is essential to effectively balance educational budgets with the platform's development

needs. Another key area for improvement is addressing the variation in students' technical skills when using the platform. For students with a limited technical foundation, the complexity of data processing and tool usage can become a barrier, impacting their learning outcomes. This skill gap affects not only individual performance but may also pose challenges in group projects and collaborative tasks. Therefore, offering structured support and technical training courses is essential to help students develop the fundamental skills necessary to operate the platform effectively. By providing supplementary technical support courses or hosting related workshops, students can become more adept at using the platform, enhancing their confidence and ability to work independently. Additionally, these training sessions can help students develop a data-driven mindset, enabling them to make more informed decisions and analyze data with greater precision.

Looking ahead, the digital transformation of financial engineering courses will continue to deepen as financial technology evolves. By incorporating cutting-edge technologies such as artificial intelligence, blockchain, and cloud computing, the curriculum can be more closely aligned with the latest developments in the financial industry. For instance, artificial intelligence can be utilized for predictive analysis and risk assessment, while blockchain provides new approaches to decentralized transactions and data security. Integrating these technologies into the big data platform not only enriches the curriculum but also offers students a diverse and advanced learning experience, allowing them to engage with the latest industry trends and develop essential, forward-looking skills during their academic journey.

In summary, the application of a big data platform is not only a crucial tool in the reform of financial engineering education but also a driving force in transforming the educational landscape. As technology continues to evolve and the platform becomes a more embedded part of the curriculum, it will play a central role in providing students with a competitive advantage in the increasingly complex financial sector. Through such digital transformation, students are better prepared to face future career challenges, becoming adaptable, technologically proficient professionals in financial engineering.

5 Research Conclusions

This study focused on the digital teaching model reform in financial engineering courses, exploring the application of the big data platform and its impact on student learning outcomes. The results indicate that the introduction of the big data platform significantly enhanced students' self-directed learning abilities and practical skills. First, students were able to adjust their learning pace based on their own needs, leveraging the platform's rich learning resources and flexible learning methods, which greatly improved learning efficiency. Second, the use of virtual laboratories and real-time market data allowed students to engage in financial practice within a simulated environment, strengthening their understanding of market fluctuations and risk management. This, in turn, enhanced their practical skills and market sensitivity.

Furthermore, data analysis showed that classroom engagement and platform usage frequency were key factors affecting students' final grades. Students who actively participated in classroom discussions and frequently used the platform performed better in exams. Although the platform greatly improved the quality of teaching, challenges such as technical maintenance and the varying technical skills among students remain. In the future, with the further integration of cutting-edge technologies like artificial intelligence and blockchain, the digital teaching model will continue to evolve in financial engineering education, providing students with more diverse and advanced learning experiences and helping them gain a competitive edge in an increasingly complex financial environment.

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