



Digital Empowerment: Reform and Innovation of Teaching and Research in Econometrics in Application-Oriented Universities

Qingjie Zhang¹, Tianfang Xu^{2,*}

¹Department of Economics&Management, Bozhou University, Bozhou, 236800, China

²School of Economics, Fuyang Normal University, Fuyang, 236041, China

*Corresponding email: 3600432475@qq.com

Abstract. Digital technologies drive the transformation of education, bringing opportunities and challenges to the teaching and research of Econometrics. Focusing on application-oriented universities, this paper analyzes the problems existing in their Econometrics courses, such as single teaching methods, disconnection between theory and practice, and lack of teaching resources. From a multi-dimensional research perspective, it constructs a digital-intelligent teaching system, covering the construction of digital teaching paradigms, the innovation of intelligent teaching methods, and the integration of digital teaching resources. This provides practical paths for the digital teaching and research of the discipline and helps cultivate economic analysis talents in the digital age.

Keywords: Digitalization; Econometrics; Teaching System

1 Introduction

In the current era, digital technologies have penetrated all areas of society at an unprecedented speed and depth, becoming the core driving force for promoting the transformation and development of various industries. As a key position for talent cultivation and knowledge inheritance, the field of education has inevitably been impacted by the digital wave, making digital transformation an inevitable trend.^[1] In the process of educational digital transformation, educational elements are undergoing comprehensive and profound changes. As an important discipline in the field of economics, Econometrics integrates economic theory, statistics, mathematics and other knowledge, aiming to reveal the objective quantitative relationships existing in economic activities and build a bridge between economic and financial theories and economic and financial phenomena. In the digital age, the teaching and research of Econometrics are also facing new opportunities and challenges. On the one hand, digital technologies provide richer data resources, powerful computational tools and diversified teaching methods for the teaching and research of Econometrics; on the other hand, they put forward higher requirements for the teaching methods, curriculum content of Econometrics and teachers' digital literacy.^[2] Therefore, in-depth research on

the integration of digitalization and the teaching and research of Econometrics has important practical significance and theoretical value.

The innovations of this paper are mainly reflected in the following three aspects. Firstly, from the research perspective, it multi-dimensionally analyzes the impact of digital technologies on the teaching and research of Econometrics in application-oriented universities, takes into account both teaching and research levels, comprehensively explores technology application and development, and provides a more comprehensive perspective for research in this field. Secondly, in terms of teaching models, it proposes a series of innovative digital teaching models. Thirdly, in the resource system, it integrates resources such as online courses and teaching software, establishes a sound digital teaching resource system, solves the current problems of scattered resources and uneven quality, and improves resource utilization rate and teaching effectiveness.

2 Analysis of the Current Situation of the Econometrics Course

2.1 Single Teaching Methods

Under the traditional teaching paradigm of Econometrics, there is a prevalent tendency toward a single teaching method, mainly manifested as teacher-centered lecture-based teaching. Teachers systematically elaborate on theoretical knowledge based on textbook content, while students are in a passive state of knowledge reception, mainly engaging in one-way listening and note-taking. This teaching model has a significant lack of interactivity, making it difficult to effectively stimulate students' cognitive engagement. Particularly in the teaching of parameter estimation methods for Econometric models, teachers overemphasize theoretical derivation and formula analysis, leading students to fall into the dilemma of mechanical knowledge absorption and lack in-depth construction of the knowledge system and critical thinking ^[3].

2.2 Separation Between Theory and Practice

In the traditional teaching system of Econometrics, there is a prominent problem of separation between theoretical teaching and practical application. In the teaching of Econometric models, teachers mostly rely on the analysis of classic cases in textbooks. These cases generally have a lag in timeliness and are difficult to reflect the complex characteristics of contemporary economic reality. This teaching model results in students only being able to mechanically master the technical processes of model construction and solution, but lacking ability transfer training for applying model tools to the analysis of real economic problems. More notably, due to the substantive lack of practical teaching links, students have significant deficiencies in the full-process processing capabilities of economic data. It is worth noting that data in the real economic environment have high heterogeneity and complexity, requiring researchers to possess professional data analysis literacy to extract effective information. However, students

trained under the traditional teaching paradigm generally exhibit a lack of methodological application capabilities and operational adaptability obstacles when facing real economic datasets^[4].

2.3 Lack of Teaching Resources

Under the traditional teaching model of Econometrics, there is an obvious shortage in the supply of teaching resources. The update of textbook content is slow, and most textbooks are still limited to the scope of classical Econometrics, with little coverage of new theories and methods in the field of modern Econometrics. This phenomenon leads to a disconnection between the knowledge learned by students and the current frontier research achievements in economics, making it difficult to meet the ability requirements of the market for relevant professional talents. The lack of digital teaching resources is also a prominent problem. In the context of digital education, diversified digital resources such as online courses, teaching software, and case libraries can provide students with more convenient and efficient learning paths. However, many application-oriented universities have made slow progress in the construction of digital teaching resources for Econometrics, resulting in students being unable to access high-quality digital learning resources.

3 Construction of a Digital-Intelligent Teaching System

3.1 Construction of a Digital Teaching Paradigm

3.1.1. Transformation of Teaching Philosophy.

Against the backdrop of the digital age, the teaching paradigm of Econometrics is undergoing profound transformation, with its core goal shifting from traditional knowledge transmission to the systematic cultivation of students' independent learning ability, innovative thinking, and practical ability. With the rapid development and popularization of digital technologies, abundant teaching resources have been efficiently disseminated through internet platforms, constructing diversified learning channels for students. Students can independently enroll in Econometrics courses covering basic theories to cutting-edge applications via platforms such as China University MOOC and Xuetang Online, meeting the needs of different cognitive levels. Meanwhile, relying on academic resource databases like CNKI (China National Knowledge Infrastructure) and Wanfang Data, students can timely access the latest research achievements in the discipline, grasp academic development trends, thereby expanding academic horizons and improving professional cognitive levels. In this context, the focus of teaching has also shifted from mere knowledge transmission to guiding students to master methods for efficient learning using digital resources, fostering their core literacy in independently acquiring, integrating, and applying knowledge^[5].

As an applied discipline, Econometrics emphasizes cultivating students' ability to solve practical economic problems through theoretical innovation. Teachers can stimulate students' innovative thinking by introducing digital tools and teaching methods.

For example, with the help of big data analysis tools, guide students to explore the inherent laws in economic data, discover new relationships between variables, and form innovative research ideas; at the same time, encourage students to independently construct and optimize econometric models using programming tools such as Python and R, and conduct personalized analysis and prediction of real economic problems, thus effectively achieving the goal of cultivating innovative practical abilities.

3.1.2. Collaborative Mechanism between Personalized Learning and Diversified Activity Design.

The iteration of digital technologies provides key support for the implementation of student-centered teaching philosophy. With the help of tools such as learning management systems and online learning platforms, teachers can collect and analyze students' learning data in real time, assess their learning behaviors and knowledge mastery, and accurately identify individual needs. Based on data analysis, teachers can provide customized guidance: push targeted review materials and tutoring videos to students who fall behind to consolidate their foundations; recommend cutting-edge Econometrics literature and challenging cases to students with strong abilities to meet their in-depth needs and promote capacity advancement. In teaching, teachers can design diversified activities such as group projects and case studies in combination with students' interests and strengths, guiding students to highlight their dominant position. Taking group projects as an example, students collaborate to complete data collection, model construction, and result analysis, fostering collaboration and problem-solving abilities. Teachers assume the role of guides, providing necessary support, stimulating students' initiative, and improving teaching effectiveness and learning experience^[6].

3.2 Innovation of Intelligent Teaching Methods

3.2.1. Online-Offline Blended Teaching.

Online-offline blended teaching provides an effective path for the innovation of Econometrics teaching by organically integrating the advantages of traditional classrooms and online learning. In this model, students complete video viewing, digital textbook study, and basic tests through online platforms before class to establish a knowledge framework; teachers then accurately identify students' cognitive weaknesses based on the learning data recorded by the platform, and conduct targeted explanations in offline classrooms, significantly improving teaching efficiency. In terms of teaching interaction, this model achieves multi-dimensional expansion. Offline classrooms promote in-depth communication through group discussions and case studies, while online platforms enhance participation through functions such as real-time voting and instant quizzes. This dual-track interaction not only deepens students' understanding of econometric methods but also helps cultivate their critical thinking and collaboration abilities. To ensure teaching effectiveness, three key aspects need to be focused on: rational allocation of online and offline teaching content and time, establishment of an effective online learning process monitoring mechanism, and continuous optimization of digital resource quality and platform functions. Through

systematic design and implementation, blended teaching can significantly improve the teaching quality and learning effectiveness of Econometrics.

3.2.2. Precision Teaching Based on Data.

The iterative development of big data technology provides a new technical path and methodological support for the innovation of Econometrics teaching. Teachers can systematically collect multi-dimensional data including learning behaviors, learning outcomes, and learning backgrounds through platforms such as learning management systems, constructing a complete student learning database. Through in-depth mining and statistical analysis of these multi-source heterogeneous data, teachers can accurately identify students' learning characteristics and cognitive shortcomings. Based on the student learning diagnosis report formed by big data analysis, teachers can build a precise tutoring system. For students who have difficulties in modules such as model estimation, targeted help is provided through specialized tutoring and targeted Q&A. Meanwhile, the data-driven teaching evaluation system can also assess teaching effectiveness from dimensions such as knowledge transmission efficiency and ability improvement, providing empirical basis for continuously optimizing teaching strategies and improving the teaching system, thereby comprehensively enhancing the teaching quality of Econometrics [7].

3.2.3. Virtual Simulation Experimental Teaching.

Virtual simulation experimental teaching integrates computer technology, network communication, and virtual reality technology to construct a highly simulated experimental environment, enabling students to complete the entire process from experimental operation to result analysis in a virtual space. It is of great value for improving students' practical ability and complex problem-solving ability. In Econometrics teaching, students can simulate various economic scenarios through virtual platforms, systematically completing the entire process of experimental design, data collection, model construction, parameter estimation, and model testing. For example, when simulating macroeconomic operations, data such as GDP and inflation can be collected to establish a VAR model or conduct cointegration analysis, thereby observing the impact of policy changes on the economic system and effectively enhancing empirical analysis and policy evaluation capabilities. This teaching model also provides an effective path for cultivating students' innovative abilities. In a virtual environment, students can break through the limitations of real conditions, independently design experimental schemes, and try various econometric methods to expand research ideas. In addition, the system can restore real work scenarios such as financial analysis and industrial evaluation, helping students familiarize themselves with professional processes through immersive operations, improving job adaptability, and laying a foundation for future career development.

3.3 Integration of Digital Teaching Resources

3.3.1. Digital Resources Empowering Econometric Teaching.

As the technological evolutionary form of paper textbooks, digital textbooks have reconstructed the knowledge dissemination mode of Econometrics through multimedia integration and interactive functions. They integrate multiple media such as text, images, audio, and dynamic demonstrations, effectively realizing the visualized presentation of abstract theories. For example, when explaining regression analysis, animations can be used to show the model construction process, and videos of actual economic cases can be embedded to strengthen students' understanding of theoretical application scenarios. Such textbooks also have prominent interactive features and dynamic updating capabilities: students can conduct in-depth learning through functions such as hyperlinks, interactive forms, and online tests; the textbook content can also be continuously iterated to timely incorporate cutting-edge disciplinary achievements, ensuring the timeliness and advanced nature of the knowledge system [8]. High-quality online courses further expand the breadth and depth of teaching content. Well-known universities at home and abroad have built systematic course systems through open course platforms, where senior scholars systematically teach basic theories, cutting-edge methods, and practical applications. Students can independently choose learning content according to their own needs, and supporting services such as discussion communities, targeted Q&A, and homework correction effectively promote learning outcomes. Teachers can also organically integrate them into offline teaching, forming a diversified and complementary teaching resource supply model to comprehensively improve teaching quality.

3.3.2. Research on the Construction of Digital-Intelligent Case Databases.

Digital-intelligent teaching case databases provide systematic empirical research support for Econometrics teaching. The case system extensively covers core fields such as macroeconomics, financial markets, and international trade, involving key issues such as economic growth, consumer behavior, and investment decisions. Each case is equipped with complete academic elements, including research background explanation, standardized data sets, reproducible econometric analysis processes, rigorous conclusion derivation, and expansive thinking questions, which effectively promote students' understanding of the application logic of theoretical methods in actual economic scenarios. With the help of digital technologies, the case database has achieved efficient retrieval and dynamic updating. Through the intelligent classification and keyword retrieval system, teachers can accurately match case resources according to teaching needs; meanwhile, the established dynamic updating mechanism continuously incorporates cutting-edge economic issues and the latest practical cases, ensuring that teaching content keeps pace with real economic development and significantly improving the timeliness and practical value of teaching. The supporting standardized digital data sets provide key support for teaching and scientific research. These data sets integrate multi-source economic data, covering multi-dimensional information such as macro indicators and micro individuals, including time series, cross-sectional data, and panel data. Students can systematically carry out model construction, pa-

parameter estimation, and empirical analysis through these data sets to comprehensively improve their data processing capabilities; teachers can promote academic research based on standardized data, facilitating the innovative development of Econometrics theories and methods.

4 Conclusion

Against the backdrop of the digital education transformation trend, the teaching and research of Econometrics are confronted with such problems as monotonous teaching methods, disconnection between theory and practice, and insufficient resources. By constructing a digital-intelligent teaching system, this paper carries out innovations from three dimensions: digital teaching paradigms, intelligent teaching methods, and digital resource integration. It improves teaching effectiveness by means of online-offline blended teaching, virtual simulation experiments and other approaches, combined with digital-intelligent case databases and digital textbooks. Meanwhile, in response to challenges such as insufficient teacher competencies, student learning heterogeneity, and resource structural contradictions, the paper proposes strategies including competency training, guidance on autonomous learning, and resource optimization. This study provides practical paths for the teaching and research of Econometrics in application-oriented universities, promotes the digital upgrading of disciplinary teaching, and helps cultivate economic analysis talents adaptable to the digital era, thus holding significant practical and theoretical value.

Acknowledgement

Bozhou University 2025 Research Startup Project “Research on the Mechanism and Effects of Artificial Intelligence on Labor Income Disparity”(BYKQ202544); Anhui Provincial Quality Engineering Project: First-Class Course: Online and Offline Blended Course of Financial Markets and Institutions (Project No. 2024xsxx086); Bozhou University Institutional Quality Engineering Project: School-Based Textbook: Financial Markets and Institutions (Project No. 2023XJXM021); “Research on the Cross-Integration of Financial Economics and Financial Engineering Courses in Applied Undergraduate Colleges”(2024XJXM086).

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