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Integrating Text Mining With DEA-Malmquist Index for Evaluating First-Class Online Course Development Efficiency

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ABSTRACT

The dynamic evaluation of development performance in nationally recognized first-class courses holds broad implications for improving the quality of online education. This study examines 512 nationally recognized first-class undergraduate online courses on iCourse platform, framing them as an input–output system and drawing on learner-generated online review data. By integrating text mining techniques with data envelopment analysis and the Malmquist index, the study dynamically assesses their development efficiency from 2019 to 2024. The findings indicate that (1) first-class course development maintained relatively high overall efficiency, although sustainability was constrained by limited post-approval investment; (2) course performance displayed a decline–rebound trajectory, primarily driven by teaching innovation; and (3) significant disciplinary differences emerged, with natural science courses exhibiting greater volatility but stronger resilience, whereas humanities and social science courses showed milder fluctuations and experienced late-stage innovation fatigue and resource aging.

KEYWORDS

First-Class Course, Development Efficiency, Text Mining, DEA, Malmquist Index

INTRODUCTION

As a well-established educational model, online courses have overcome geographical and temporal constraints, significantly promoting educational equity and enhancing teaching quality (Bettiol et al., 2022). In 2019, China's Ministry of Education launched the *Implementation Opinions on the Development of First-Class Undergraduate Courses*, setting the goal of developing approximately 4,000 high-quality online courses (Ministry of Education, 2019). Since then, both national and

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provincial governments have cumulatively invested substantial financial and platform resources in course development. By August 2025, 3,968 online courses had been officially accredited as "first-class"—a near-perfect achievement on paper. Yet, beneath the surface of this success lies a critical question: Does "first-class" still mean "high-quality"?

In practice, many first-class courses experience a decline in popularity after accreditation, characterized by insufficient ongoing maintenance, outdated content, reduced interaction, negative learner feedback, and sharply decreasing enrollment. One study even indicated that in Chinese universities, the average completion rates of massive open online courses (MOOCs) fluctuated around 5%–10% (Qian et al., 2024). In fact, the original intent of the First-Class Course Initiative was to view the development of first-class online courses as an ongoing process of quality enhancement, in which accreditation marks the starting point rather than the end of improvement. Previous studies also stressed that continuous, data-driven teaching practices are essential for building effective online learning environments, indicating that course evaluation and quality improvement must be dynamic and synchronized with the teaching cycle (Martin et al., 2020).

One key reason for these issues is that the existing evaluation model is overly "static" and "lagging." Current evaluations mainly rely on expert reviews, which, although authoritative, are costly, limited in sample size, and have long assessment cycles, failing to capture learner perspectives and cannot fully reflect the ongoing state of courses. Similarly, questionnaire surveys, while providing learner perspectives, suffer from small samples and one-off measurements, effectively offering only "snapshot" insights. Together, these approaches leave critical post-accreditation changes largely invisible. In contrast, learner review data generated on learning platforms provide high-frequency, continuous, real-time feedback (Peng & Xu, 2020). Temporally distributed across different phases of development, these reviews provide dynamic reflections of learners' perceptions of course quality. Meanwhile, the development of first-class online courses can be viewed as a dynamic input–output system, with continuous inputs and outputs. Therefore, an integrated text mining and data envelopment analysis (DEA)–Malmquist index approach offers a robust and essential means of dynamically assessing the performance of such systems, effectively addressing the blind spots of traditional methods.

In response, this study integrated text mining techniques with the DEA and Malmquist index to construct a review text-driven framework for dynamically evaluating course development efficiency, based on data from national first-class courses on the Chinese University MOOC platform. Specifically, three research questions were investigated:

1. How can text mining and the DEA–Malmquist index be combined to measure development efficiency dynamically?
2. What is the overall efficiency of these first-class online courses, and is there evidence of efficiency decline after their accreditation?
3. If such a decline exists, to what extent does it vary across different disciplinary fields?

LITERATURE REVIEW

Snapshots Versus Motion: Limitations of Conventional Evaluation Methods

With the advancement of digital transformation in education, online courses have become a critical vehicle for innovation in higher education, and the evaluation of their development performance has attracted increasing scholarly attention. Existing research can be broadly classified into two models: the expert evaluation model and the learner questionnaire survey model.

The expert-led model relies mainly on the knowledge and experience of experts to establish evaluation indicator systems and provide a relatively systematic assessment of online course