


An Enhanced Uncertain Framework for Multiple-Attribute Decision-Making: Application to Comprehensive Practical Teaching Quality Evaluation in Marketing Majors

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ABSTRACT

The comprehensive practical teaching model for marketing majors formulates a systematic and feasible practical teaching approach from the perspective of overall program development, aiming to promote the long-term growth of the discipline and accelerate the pace of practical teaching reform. To address the multiple-attribute decision-making challenge of evaluating marketing majors' comprehensive practical teaching quality, this study leverages triangular fuzzy neutrosophic sets (TFNSs)—a robust tool for capturing uncertain information in such assessments. Building on recent applications of evaluation based on distance from average solution (EDAS) and Criteria Importance Through Intercriteria Correlation (CRITIC) methods in multiple-attribute decision-making, a triangular fuzzy neutrosophic number EDAS (TFNN-EDAS) model integrates TFNN Hamming distance to handle TFNS-based uncertainty. The CRITIC approach is employed to derive attribute weights via TFNN Hamming distance under the TFNS framework. A numerical example focused on marketing practical teaching quality evaluation is presented, alongside comparative analyses, to validate the proposed TFNN-EDAS method's effectiveness and reliability.

KEYWORDS

Multiple-Attribute Decision-Making (MADM), TFNSS, EDAS Technique, Information Entropy, Comprehensive Practical Teaching Quality Evaluation

INTRODUCTION

Marketing, the core professional course for marketing majors, rooted in economics, behavioral science, and modern management theories, is an applied discipline characterized by comprehensiveness and an interdisciplinary nature. The course aims to help students grasp the basic theories, knowledge, and methods of marketing, foster a firm customer-centric marketing mindset, emphasize the cultivation of practical application abilities, and strengthen hands-on marketing training. It equips students to effectively organize enterprise operations in real-world scenarios, enabling businesses to conduct market-oriented marketing activities such as product development, production, pricing, distribution, and promotion—ultimately enhancing corporate management standards and economic efficiency.

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However, in the current classroom teaching of marketing in most vocational colleges, the majority of teachers still adopt outdated instructional methods relying solely on a textbook, chalk, lectures, and a blackboard. Students passively absorb knowledge in class and lack interest in the content delivered by teachers. Amid the advancement of information-based teaching reforms, although many teachers have attempted approaches like multimedia-assisted teaching, classroom discussions, and case studies, significant deficiencies persist in practical training. Students struggle to apply theoretical knowledge to real-world situations, resulting in difficulties in improving their professional skills and problem-solving capabilities.

Over the past decades, studies on practical teaching quality evaluation and marketing-specific practical education have evolved from foundational framework building to discipline-targeted, technology-integrated approaches. In 2009, C. Li et al. (2009) pioneered research on comprehensive evaluation systems for university practical teaching quality, publishing a seminal study that established core principles and preliminary structures for assessing practical education effectiveness—laying critical groundwork for subsequent disciplinary-specific investigations. Building on this foundation, Lu and Han (2010) applied the team project training method to marketing practical teaching, using the “Walk with Love” marketing planning training as a concrete case to demonstrate how collaborative project-based learning could enhance students’ practical skills, marking one of the earliest discipline-specific practical teaching innovations in marketing.

The mid-2010s witnessed diversified and methodologically enriched research. In 2014, Manap and Voulvoulis (2014) shifted focus to infrastructure support, arguing that strengthening the construction of liberal arts comprehensive experimental teaching demonstration centers was pivotal to improving practical teaching quality, and proposed targeted strategies for center development and resource integration. Next, in a landmark year for specialized and method-driven studies, Jiang (2015) advocated optimizing marketing practical teaching through comprehensive training and competition systems, highlighting the role of competitive simulation in bridging theory and practice; and L. Zhang (2015) introduced fuzzy comprehensive evaluation methods to assess practical teaching quality in finance and economics programs, offering a quantitative tool to handle the inherent uncertainty of educational evaluations—an approach later adapted by marketing education researchers. In the late 2010s, research advanced toward vocational education adaptation and intelligent evaluation. Du (2018) focused on higher vocational marketing programs, taking Hainan Software Vocational and Technical College as a case study to design preliminary pre-job comprehensive skills training frameworks, addressing the industry’s demand for job-ready graduates. Gao et al. (2019) pushed the field further by developing an intelligent multi-perspective evaluation system for practical teaching training and quality, integrating data-driven assessment tools to enhance objectivity and efficiency.

Collectively, these studies reflected a clear evolution: from general university-wide frameworks to marketing-specific models, from traditional teaching method innovations to fuzzy evaluation and intelligent systems, and from undergraduate to vocational education adaptation—gradually forming a comprehensive body of knowledge supporting practical teaching quality enhancement in marketing and related fields.

Multi-attribute decision making (MADM) refers to a structured approach for selecting, ranking, or evaluating a finite set of alternatives based on multiple, often conflicting, criteria (Deng et al., 2026; Zhao & Chen, 2025; Zhou et al., 2025; Zulqarnain et al., 2025). It is a fundamental process in management science and operations research used to tackle complex choices where no single option excels in every aspect (Ning et al., 2025a, 2025b; Ning, Wei, Wei, & Pena, 2025; X. Xu et al., 2026). The typical procedure involves defining alternatives and relevant attributes, assigning weights to signify the importance of each criterion, normalizing performance scores for comparison, and finally applying a specific mathematical aggregation method to synthesize the data into an overall preference order (Lei et al., 2023; Wang et al., 2024; Y. J. Y. Zhang et al., 2024). Common methods include Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS), Analytic Hierarchy Process (AHP), and the evaluation based on distance from average solution (EDAS), each with its own logic for

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