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Modified Collaborative Group Decision-Making Framework for Innovation and Entrepreneurship Education Quality Evaluation With Intuitionistic Fuzzy Sets

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ABSTRACT

The quality evaluation of vocational colleges' innovation and entrepreneurship education (IEE), integrating professional skills and industrial demands, is a multi-dimensional, uncertain process crucial for optimizing talent cultivation and educational strategies. The quality evaluation of innovation and entrepreneurship education (IEE) in vocational colleges falls into the category of multi-attribute group decision-making (MAGDM). Intuitionistic fuzzy sets (IFSs) are adopted to depict uncertain evaluation information, with a numerical study on quality evaluation of vocational colleges' IEE used to validate the proposed method. The CRITIC technique is adopted to quantify the attribute weights in a objective manner. As the Evaluation based on Distance from Average Solution (EDAS) technique has recently proven effective in addressing MAGDM problems, this paper develops an intuitionistic fuzzy number EDAS (IFN-EDAS) technique based on Hamming distance. Finally, a numerical study for quality evaluation of IEE in vocational colleges is supplied to validate the proposed technique.

KEYWORDS

Group Decision-Making (MAGDM), Intuitionistic Fuzzy Sets (IFSs), EDAS Technique, CRITIC Technique, Innovation and Entrepreneurship Education

INTRODUCTION

In the context of deepening integration between industry and education, higher vocational institutions are called upon to foster an evolving mindset toward innovation and entrepreneurship education (IEE). It is essential to recognize that such education serves as a vital pathway not only to enhance students' overall competencies and employability but also to contribute meaningfully to socioeconomic progress (Abdulwahed, 2017; Ben Hassen, 2022). Accordingly, these colleges should formulate clear, actionable educational objectives aligned with their institutional strengths and societal demands. By embedding these goals throughout the entire talent development process, educators can more effectively nurture students' innovative thinking and initiative. Furthermore, close alignment with local industrial development needs is crucial. Higher vocational colleges ought to

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cultivate innovators and entrepreneurs who can address regional industrial requirements and leverage local economic advantages. This approach supports the construction of a comprehensive, multi-tiered system for IEE. Ultimately, such efforts provide sustained intellectual and talent support for local economic growth and industrial upgrading (Y. Zhang et al., 2025; X. Zhang & Li, 2025; Zhuang, 2025). In the teaching of professional courses, teachers should pay attention to the deep integration of professional courses and IEE, tap the elements of innovation and entrepreneurship, guide students to solve professional problems with innovative thinking, and cultivate their entrepreneurial awareness (G. H. Li, 2017; Niccum et al., 2017). Constructing a modular and practical curriculum system is the key to the reform of IEE in higher vocational colleges. Among them, the basic theory module, as the cornerstone of talent training in higher vocational colleges, covers courses such as innovative thinking training, entrepreneurship foundation, marketing, and financial management, which cultivate students' innovative thinking, entrepreneurial cognition, marketing, and financial management abilities, respectively. The professional skill module combines the professional characteristics of students and integrates IEE into it; the practical training module is the core, which trains students' team cooperation ability through the practice of entrepreneurial projects (Cao & Zhou, 2018; Quan & Zhou, 2018).

In the domain of instructional design, adopting a diverse and flexible approach is essential. Educators are encouraged to leverage digital tools and resources to enrich the learning experience and elevate educational outcomes. A hybrid model that thoughtfully blends online and offline formats is highly recommended, alongside the integration of foundational general courses with specialized professional training. Equally important is the balance between theoretical knowledge and hands-on application, as well as the fusion of structured project-based work with more open-ended activity-driven learning. Introducing actual case studies from the entrepreneurial world can serve as a powerful teaching tool. By facilitating guided group discussions around these real-life scenarios, instructors can actively nurture students' analytical thinking and problem-solving capabilities. This method helps learners move beyond abstract concepts to grasp the practical nuances of market evolution and sector-specific trends. Such an immersive, discussion-oriented environment not only deepens comprehension but also prepares students to interpret and respond to the dynamics of real industries. Ultimately, this multi-faceted pedagogical strategy supports a more adaptive and resilient educational process. It allows theoretical principles to be continually tested and applied within practical contexts, bridging the gap between classroom learning and professional demands. Through continued reflection and collaborative dialogue, students cultivate a more intuitive and critical understanding of the forces shaping today's business landscape (Boysen et al., 2020; Dobson & McLuskie, 2020). In project practice, students should participate in all links of the project in the whole process. Enterprise mentors should give timely guidance. After students master the entrepreneurial process and methods, set up entrepreneurship-related scenarios, let students play different roles, intuitively feel entrepreneurial challenges, improve their team cooperation and adaptability, and stimulate their entrepreneurial interest (Xiang et al., 2025; B. Yin et al., 2025; Zeynalov & Doantan, 2025). Innovation and entrepreneurship practice activities are important ways to improve students' abilities. Higher vocational colleges should continuously strengthen the construction and improvement of on-campus training bases, arrange internships according to students' majors and interests, negotiate with enterprises, and jointly build IEE bases to help students familiarize themselves with processes, learn management modes, and continuously improve their practical abilities (C. L. Wang et al., 2022). Specifically, it should be promoted from three aspects: First, hold innovation and entrepreneurship competitions. Through team formation, project conception, business plan writing, on-site display and defense, students' team cooperation and communication skills are exercised, and their business cognition and market insight are improved. Second, organize the practice of entrepreneurial projects. The school provides resource support to help students' ideas land. In the process of project promotion, students gradually improve their practical innovation and entrepreneurship abilities by solving practical problems such as funds, operation and market. Third, carry out entrepreneurship simulation training (Luo, 2025;