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Retraction

Retracted: Research on the English Classroom Teaching Effect Evaluation with Interval-Valued Intuitionistic Fuzzy Grey Relational Analysis Method

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Z. Zhang and P. Su, "Research on the English Classroom Teaching Effect Evaluation with Interval-Valued Intuitionistic Fuzzy Grey Relational Analysis Method," *Mathematical Problems in Engineering*, vol. 2022, Article ID 7445250, 11 pages, 2022.

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Research Article

Research on the English Classroom Teaching Effect Evaluation with Interval-Valued Intuitionistic Fuzzy Grey Relational Analysis Method

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The English classroom teaching effect evaluation is looked as the multiattribute group decision-making (MAGDM). Thus, a useful MAGDM algorithm is needed to cope with it. Depending on the classical GRA process and interval-valued IFSs (IVIFSs), this study builds the IVIF-GRA process to assess the English classroom teaching effect. First of all, the concepts of IVIFSs are reviewed. In addition, the weights of criteria are derived through the CRITIC method. Afterwards, the GRA model is extended to IVIFSs to get the final result of the alternative. Therefore, all alternatives could be ranked and the optimal one with English classroom teaching effect can be identified. At last, a given numerical example and some given comparative studies are obtained. The analysis results show that the defined algorithms are effective for solving the English classroom teaching effect evaluation.

1. Introduction

Since the decision-making process is full of uncertainty and fuzziness [1–6], Zadeh [7] designed the fuzzy sets (FSs) to deal with the accuracy issues of decision-making. Atanassov [8] built the intuitionistic fuzzy sets (IFSs) to depict uncertain issues. Milovanović et al. [9] built uncertainty modeling using IFSs. Gupta et al. [10] designed the fuzzy mathematical entropy under IFSs. Xiao et al. [11] built the intuitionistic fuzzy Taxonomy decision method. Bao et al. [12] built the prospect theory as well as novel evidential reasoning with IFSs. Phochanikorn and Tan [13] merged DEMATEL through ANP to obtain interdependencies as well as uncertainties under IFSs. Rouyendegh [14]used the ELECTRE process with IFSs. Hao et al. [15] devised the novel decision fields' method for IF-MADM. Li et al. [16] defined the grey target based on real decision-making under IFSs. Zhao et al. [17] built the IF-MABAC model based on cumulative prospect theory for MAGDM. Liang et al. [18] built the IF-MABAC method with distance measures. Khan and Lohani [19] devised the similarity mathematical measure about IFSs. Chen et al. [20] developed IF-TOPSIS under similarity measures. Zhang and He [21] built the geometric interaction information-fused methods under IFSs. Joshi and Kumar [22] defined an extended VIKOR method under IFSs. Kumar and Garg [23] defined the TOPSIS method under IVIFSs. Xiao et al. [24] used the taxonomy method for MAGDM based on IVIFSs with given entropy.

Similar to the TOPSIS method [25–27], EDAS method [28–31], and TODIM method [32–37], the GRA model was initially defined by Deng [38] to cope with real MAGDM. Compared with other MAGDM [39–44], the GRA model could consider the given shape similarity of every given alternative from given PIS as well as NIS. Javanmardi et al. [45] explored the philosophical foundations of grey theory. Javanmardi et al. [46] explored grey systems theory-based methods and applications in sustainability studies. Javanmardi et al. [47] explored the philosophical paradigm of grey theory. Javanmardi and Liu [48] explored the grey theory perspective. Javanmardi [49] explored grey theory-based methods and applications in real socio-economic systems. Zhang et al. [50] used GRA algorithm based on cumulative prospect theory for IF-MAGDM. With the purpose of discerning the carbon market, Zhu et al. [51] took advantage of GRA algorithm as well as EMD. Alptekin et al. [52] solved the low carbon issues based on GRA process. Malek et al. [53] built a revised hybrid GRA algorithm for green supply. Kung and Wen [54] used GRA algorithm to solve the given grey MADM. Xie et al. [55] extended the grey relational analysis with the comparable degree for dual probabilistic multiplicative linguistic term set.

English writing is very important to college school English learning, but the current teaching situation of English writing is not satisfactory. Students lack interest in English writing, and teachers have made a lot of effort but have achieved little effect [56]. Many studies attempt to adopt the teaching mode of flipped classroom from the perspective of ecological teaching to increase students' interest in English writing and improve their English writing ability effectively [57]. The mode of flipped classroom subverts the teaching mode "teaching before practicing" in traditional class and replaces teachers' teaching during the whole class by students' learning independently before class. In class, the interaction between teacher and students can attribute to completing the internalization of knowledge and enabling students to become true masters in the class [58]. The theoretical foundations of the flipped classroom are ecological teaching. Ecological teaching is the application of the concept of ecology to education. It regard teachers, students, teaching environment, and educational resources as ecological factors, aiming to create a dynamic, interactive, and balanced teaching environment [59]. Xu [60] evaluated the teaching effect with intuitionistic trapezoidal fuzzy numbers. Geng [61] assessed the multimedia teaching effect based on deep neural networks. Liu and Qi [62] assessed the flipped classroom in oral English teaching. Wang [63] built the TOPSIS for teaching effect evaluation of college English with IVIFSs.

Unfortunately, in the given existing literature, we fail to find out the corresponding works of the IVIF-GRA method with CRITIC. Thus, it is imperative to extend the GRA method in IVIFSs. The elementary aim of such study is to solve the MAGDM efficiently with GRA and IVIFSs. Most especially, extend GRA algorithm to the IVIFSs. On the other side, the CRITIC method is used to get the attribute's weight. Then, a given application is used to certify such defined model, and several given comparative studies are used to certify the advantages of the built model. The motivations of the paper can be given as follows: (1) the GRA algorithm is used to deal with MAGDM under IVIFSs, (2) the weights of attribute is obtained objectively through the given CRITIC method, (3) a numerical example for English classroom teaching effect evaluation is given to show the built approach, and (4) some given comparative studies are given.

The reminder of this study is as follows. Some necessary ideas of IVIFSs are given in Section 2. The GRA process for real MAGDM is revised with IVIFSs; then, the calculating procedures are designed in Section 3. A numerical example for English classroom teaching effect evaluation is given; also, some comparative analysis is given in Section 4. In the end, we give the conclusion in Section 5.

2. Preliminaries

2.1. IVIFSs

Definition 1 (see [64]). The IVIFSs based on X is defined:

$$P = \{\langle x, \widetilde{\mu}_P(x), \widetilde{\nu}_P(x)\rangle | x \in X\}, \tag{1}$$

which $\widetilde{\mu}_P(x) \subset [0,1]$ is used to show as "membership of P," $\widetilde{\nu}_P(x) \subset [0,1]$ is used to show as "nonmembership of P," and $\widetilde{\mu}_P(x)$ and $\widetilde{\nu}_P(x)$ meet condition, $0 \leq \sup\widetilde{\mu}_P(x) + \sup\widetilde{\nu}_P(x) \leq 1$, $\forall x \in X$.

Definition 2 (see [65]). Let $P_1 = ([\mu_1^L, \mu_1^R], [\nu_1^L, \nu_1^R])$ and $P_2 = ([\mu_2^L, \mu_2^R], [\nu_2^L, \nu_2^R])$ be two IVIFNs; then, the operation rules are defined:

$$\begin{aligned}
P_1 \oplus P_2 &= \left(\left[\mu_1^L + \mu_2^L - \mu_1^L\mu_2^L, \mu_1^R + \mu_2^R - \mu_1^R\mu_2^R\right], \left[\nu_1^L\nu_2^L, \nu_1^R\nu_2^R\right]\right),\\
P_1 \otimes P_2 &= \left(\left[\mu_1^L\mu_2^L, \mu_1^R\mu_2^R\right], \left[\nu_1^L + \nu_2^L - \nu_1^L\nu_2^L, \nu_1^R + \nu_2^R - \nu_1^R\nu_2^R\right]\right),\\
\lambda P_1 &= \left(\left[1-\left(1-\mu_1^L\right)^{\lambda}, 1-\left(1-\mu_1^R\right)^{\lambda}\right], \left[\left(\nu_1^L\right)^{\lambda}, \left(\nu_1^R\right)^{\lambda}\right]\right), \quad \lambda > 0,\\
P_1^{\lambda} &= \left(\left[\left(\mu_1^L\right)^{\lambda}, \left(\mu_1^R\right)^{\lambda}\right], \left[1-\left(1-\lambda_1^L\right)^{\lambda}, 1-\left(1-\lambda_1^R\right)^{\lambda}\right]\right), \quad \lambda > 0.
\end{aligned} \tag{2}$$

Definition 3 (see [66]). Let $P_1 = ([\mu_1^L, \mu_1^R], [\nu_1^L, \nu_1^R])$ and $P_2 = ([\mu_2^L, \mu_2^R], [\nu_2^L, \nu_2^R])$ be two IVIFNs; the score and accuracy functions are defined:

$$\begin{aligned}
S(P_1) &= \frac{\left(1 + \mu_1^L - \nu_1^L\right) + \left(1 + \mu_1^R - \nu_1^R\right)}{4}\\
S(P_2) &= \frac{\left(1 + \mu_2^L - \nu_2^L\right) + \left(1 + \mu_2^R - \nu_2^R\right)}{4},\\
H(P_1) &= \frac{\mu_1^L + \nu_1^L + \mu_1^R + \nu_1^R}{4},\\
H(P_2) &= \frac{\mu_2^L + \nu_2^L + \mu_2^R + \nu_2^R}{4}.
\end{aligned} \tag{3}$$

Definition 4 (see [67]). Let $P_1 = ([\mu_1^L, \mu_1^R], [\nu_1^L, \nu_1^R])$ and $P_2 = ([\mu_2^L, \mu_2^R], [\nu_2^L, \nu_2^R])$ be two IVIFNs; the Hamming distance between two IVIFNs is

$$\mathrm{HD}(P_1, P_2) = \frac{\left|\mu_1^L - \mu_2^L\right| + \left|\mu_1^R - \mu_2^R\right| + \left|\nu_1^L - \nu_2^L\right| + \left|\nu_1^R - \nu_2^R\right|}{4}. \tag{4}$$

2.2. Two Operators under IVIFSs. The IVIFWA and IVIFWG operator is given [68].

Definition 5 (see [68]). Let $P_j = ([\mu^L_{P_j}, \mu^R_{P_j}], [\nu^L_{P_j}, \nu^R_{P_j}])$ $(j = 1, 2, \ldots, n)$ be a group of IVIFNs; the IVIFWA is

$$\begin{aligned}\text{IVIFWA}_\omega(P_1, P_2, \ldots, P_n) &= \overset{n}{\underset{j=1}{\oplus}}(\omega_j P_j) \\ &= \left(\left[1 - \prod_{j=1}^{n}\left(1 - \mu^L_{P_j}\right)^{\omega_j}, 1 - \prod_{j=1}^{n}\left(1 - \mu^R_{P_j}\right)^{\omega_j}\right], \left[\prod_{j=1}^{n}\left(\nu^L_{P_j}\right)^{\omega_j}, \prod_{j=1}^{n}\left(\nu^R_{P_j}\right)^{\omega_j}\right]\right),\end{aligned} \tag{5}$$

where $\omega = (\omega_1, \omega_2, \ldots, \omega_n)^T$ is weight information of P_j $(j = 1, 2, \ldots, n)$ and $\omega_j > 0, \sum_{j=1}^{n} \omega_j = 1$.

Definition 6 (see [68]). Let $P_j = ([\mu^L_{P_j}, \mu^R_{P_j}], [\nu^L_{P_j}, \nu^R_{P_j}])$ $(j = 1, 2, \ldots, n)$ be a group of IVIFNs; the IVIFWG is

$$\begin{aligned}\text{IVIFWG}_\omega(P_1, P_2, \ldots, P_n) &= \overset{n}{\underset{j=1}{\otimes}}(P_j)^{\omega_j} \\ &= \left(\left[\prod_{j=1}^{n}\left(\mu^L_{P_j}\right)^{\omega_j}, \prod_{j=1}^{n}\left(\mu^R_{P_j}\right)^{\omega_j}\right], \left[1 - \prod_{j=1}^{n}\left(1 - \nu^L_{P_j}\right)^{\omega_j}, 1 - \prod_{j=1}^{n}\left(1 - \nu^R_{P_j}\right)^{\omega_j}\right]\right),\end{aligned} \tag{6}$$

where $\omega = (\omega_1, \omega_2, \ldots, \omega_n)^T$ is the weight of $P_j (j = 1, 2, \ldots, n)$ and $\omega_j > 0, \sum_{j=1}^{n} \omega_j = 1$.

3. GRA Algorithm for MAGDM with IVIFNs

This section proposes the IVIF-GRA process for MAGDM. Let $A = \{A_1, A_2, \ldots, A_n\}$ be the set of attributes and $w = \{w_1, w_2, \ldots, w_n\}$ be the attribute weight A_j, where $w_j \in [0, 1], j = 1, 2, \ldots, n, \sum_{j=1}^{n} w_j = 1$. Assume $H = \{H_1, H_2, \ldots, H_l\}$ be a group of DMs that have weight information of $h = \{h_1, h_2, \ldots, h_l\}$, where $h_k \in [0, 1]$, $k = 1, 2, \ldots, l$ and $\sum_{k=1}^{l} h_k = 1$. Let $P = \{P_1, P_2, \ldots, P_m\}$ be a group of alternatives. And $Q = ({}^{ij}_{q})_{m\times n}$ is the decision matrix, where ${}^{ij}_{q}$ depicts the given value of P_i for A_j. Afterwards, the calculating steps are listed.

Step 1: build the matrix $Q^{(k)} = (q^k_{ij})_{m\times n}$; then, the overall matrix is depicted as $Q = (q_{ij})_{m\times n}$:

$$\begin{aligned}Q^{(k)} &= \left[q^k_{ij}\right]_{m\times n} = \begin{bmatrix} q^k_{11} & q^k_{12} & \cdots & q^k_{1n} \\ q^k_{21} & q^k_{22} & \cdots & q^k_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ q^k_{m1} & q^k_{m2} & \cdots & q^k_{mn} \end{bmatrix}, \\ Q &= \left[q_{ij}\right]_{m\times n} = \begin{bmatrix} q_{11} & q_{12} & \cdots & q_{1n} \\ q_{21} & q_{22} & \cdots & q_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ q_{m1} & q_{m2} & \cdots & q_{mn} \end{bmatrix}, \\ q_{ij} &= \left(\left[\prod_{k=1}^{l}\left(\mu^L_{q^k_{ij}}\right)^{h_k}, \prod_{k=1}^{l}\left(\mu^R_{q^k_{ij}}\right)^{h_k}\right], \left[1 - \prod_{k=1}^{l}\left(1 - \nu^L_{q^k_{ij}}\right)^{h_k}, 1 - \prod_{k=1}^{l}\left(1 - \nu^R_{q^k_{ij}}\right)^{h_k}\right]\right),\end{aligned} \tag{7}$$

where q^k_{ij} is the IVIFNs of $P_i (i = 1, 2, \ldots, m)$ for $A_j (j = 1, 2, \ldots, n)$ and $H_k (k = 1, 2, \ldots, l)$.

Step 2: normalize the matrix $Q = (q_{ij})_{m\times n}$ to $Q^N = [q^N_{ij}]_{m\times n}$ with IVIFNs:

$$q_{ij}^N = \begin{cases} \left(\left[\mu_{ij}^L, \mu_{ij}^R\right], \left[\nu_{ij}^L, \nu_{ij}^R\right]\right), & A_j \text{ is a benefit criterion,} \\ \left(\left[\nu_{ij}^L, \nu_{ij}^R\right], \left[\mu_{ij}^L, \mu_{ij}^R\right]\right), & A_j \text{ is a cost criterion.} \end{cases} \quad (8)$$

Step 3: use the CRITIC to get the attributes' weight.

The CRITIC was defined by Diakoulaki et al. [69]. The CRITIC has been used in different setting and connected with methods [70–74]. Whereafter, the compute procedures of such method are designed.

(1) Depending on the normalized matrix, the given correlation coefficient between attributes could be obtained:

$$CC_{jr} = \frac{\sum_{i=1}^m \left(H\left(q_{ij}^N\right) - H\left(q_j^N\right)\right)\left(H\left(q_{ir}^N\right) - H\left(q_r^N\right)\right)}{\sqrt{\sum_{i=1}^m \left(H\left(q_{ij}^N\right) - H\left(q_j^N\right)\right)^2}\sqrt{\sum_{i=1}^m \left(H\left(q_{ir}^N\right) - H\left(q_r^N\right)\right)^2}}, \quad j, r = 1, 2, \ldots, n, \quad (9)$$

where $H(q_j^N) = (1/m)\sum_{i=1}^m H(q_{ij}^N)$ and $H(q_r^N) = (1/m)\sum_{i=1}^m H(q_{ir}^N)$.

(2) Calculate attributes' standard deviation:

$$SD_j = \sqrt{\frac{1}{m-1}\sum_{i=1}^m \left(H\left(q_{ij}^N\right) - H\left(q_j^N\right)\right)^2}, \quad j = 1, 2, \ldots, n, \quad (10)$$

where $H(q_j^N) = (1/m)\sum_{i=1}^m H(q_{ij}^N)$.

(3) Calculate the attributes' weights:

$$ta_j = \frac{SD_j \sum_{t=1}^n \left(1 - CC_{jr}\right)}{\sum_{j=1}^n \left(SD_j \sum_{t=1}^n \left(1 - CC_{jr}\right)\right)}, \quad j = 1, 2, \ldots, n, \quad (11)$$

where $ta_j \in [0, 1]$ and $\sum_{j=1}^n ta_j = 1$.

Step 4: build positive ideal solution (PIS) IVIFPIS_j and the corresponding negative ideal solution (NIS) IVIFNIS_j through equations (12) and (13):

$$\text{IVIFPIS}_j = \left(\left[\mu_j^{L+}, \mu_j^{R+}\right], \left[\nu_j^{L+}, \nu_j^{R+}\right]\right), \quad (12)$$

$$\text{IVIFNIS}_j = \left(\left[\mu_j^{L+}, \mu_j^{R+}\right], \left[\nu_j^{L+}, \nu_j^{R+}\right]\right), \quad (13)$$

where $\text{IVIFPIS}_j = \begin{pmatrix} [\max_j(\mu_{ij}^L), \max_j(\mu_{ij}^R)], \\ [\min_j(\nu_{ij}^L), \min_j(\nu_{ij}^R)] \end{pmatrix}$ and $\text{IVIFNIS}_j = \begin{pmatrix} [\min_j(\mu_{ij}^L), \min_j(\mu_{ij}^R)], \\ [\max_j(\nu_{ij}^L), \max_j(\nu_{ij}^R)] \end{pmatrix}$.

Step 5: the grey relational coefficient (GRC) of each alternative between each alternative and IVIFIVPIS and IVIFPIS is given

$$\begin{aligned} \text{IVIFPIS}\left(\xi_{ij}\right) &= \frac{\min_{1\le i\le m}\text{HD}\left(q_{ij}^N, \text{IVIFPIS}_j\right) + \rho\max_{1\le i\le m}\text{HD}\left(q_{ij}^N, \text{IVIFPIS}_j\right)}{\text{HD}\left(q_{ij}^N, \text{IVIFPIS}_j\right) + \rho\max_{1\le i\le m}\text{HD}\left(q_{ij}^N, \text{IVIFPIS}_j\right)}, \\ \text{IVIFNIS}\left(\xi_{ij}\right) &= \frac{\min_{1\le i\le m}\text{HD}\left(q_{ij}^N, \text{IVIFNIS}_j\right) + \rho\max_{1\le i\le m}\text{HD}\left(q_{ij}^N, \text{IVIFNIS}_j\right)}{\text{HD}\left(q_{ij}^N, \text{IVIFNIS}_j\right) + \rho\max_{1\le i\le m}\text{HD}\left(q_{ij}^N, \text{IVIFNIS}_j\right)}, \\ & i = 1, 2, \ldots, m, j = 1, 2, \ldots, n. \end{aligned} \quad (14)$$

Step 6: figuring out the degree of GRC of all alternatives from IVIFPIS and IVIFNIS,

$$\begin{aligned} \text{IVIFPIS}\left(\xi_i\right) &= \sum_{j=1}^n w_j \text{IVIFPIS}\left(\xi_{ij}\right), \quad i = 1, 2, \ldots, m, \\ \text{IVIFNIS}\left(\xi_i\right) &= \sum_{j=1}^n w_j \text{IVIFNIS}\left(\xi_{ij}\right), \quad i = 1, 2, \ldots, m. \end{aligned} \quad (15)$$

Step 7: compute each alternative's IVIF relative relational degree (IVIFRRD) from IVIFPIS:

$$\text{IVIFRRD}_i = \frac{\text{IVIFNIS}\left(\xi_i\right)}{\text{IVIFNIS}\left(\xi_i\right) + \text{IVIFPIS}\left(\xi_i\right)}, \quad i = 1, 2, \ldots, m. \quad (16)$$

Step 8: according to $\text{IVIFRRD}_i (i = 1, 2, \ldots, m)$, the highest value of $\text{IVIFRRD}_i (i = 1, 2, \ldots, m)$, the optimal choice is.

Table 1: IVIF matrix by H_1.

	A_1	A_2	A_3	A_4
P_1	([0.59,0.62],[0.26,0.38])	([0.63,0.70],[0.25,0.30])	([0.37,0.45],[0.55,0.60])	([0.62,0.70],[0.25,0.30])
P_2	([0.65,0.75],[0.20,0.25])	([0.35,0.40],[0.55,0.60])	([0.55,0.62],[0.28,0.38])	([0.36,0.40],[0.55,0.60])
P_3	([0.37,0.40],[0.53,0.60])	([0.42,0.48],[0.50,0.52])	([0.55,0.60],[0.32,0.40])	([0.37,0.45],[0.50,0.55])
P_4	([0.61,0.65],[0.30,0.35])	([0.38,0.42],[0.52,0.58])	([0.52,0.62],[0.30,0.38])	([0.70,0.80],[0.10,0.20])
P5	([0.35,0.45],[0.50,0.55])	([0.61,0.65],[0.30,0.35])	([0.59,0.65],[0.30,0.35])	([0.19,0.25],[0.70,0.75])

Table 2: IVIF matrix by H_2.

	A_1	A_2	A_3	A_4
P_1	([0.41,0.45],[0.50,0.55])	([0.36,0.41],[0.56,0.59])	([0.73,0.81],[0.14,0.22])	([0.60,0.70],[0.25,0.30])
P_2	([0.36,0.40],[0.57,0.60])	([0.70,0.80],[0.15,0.20])	([0.57,0.62],[0.30,0.38])	([0.29,0.36],[0.58,0.64])
P_3	([0.29,0.35],[0.60,0.65])	([0.55,0.62],[0.27,0.38])	([0.35,0.40],[0.51,0.60])	([0.32,0.40],[0.55,0.60])
P_4	([0.53,0.60],[0.35,0.40])	([0.28,0.46],[0.50,0.54])	([0.62,0.70],[0.25,0.30])	([0.60,0.65],[0.30,0.35])
P_5	([0.46,0.52],[0.40,0.48])	([0.52,0.60],[0.35,0.40])	([0.25,0.31],[0.66,0.71])	([0.47,0.55],[0.40,0.45])

Table 3: IVIF matrix by H_3.

	A_1	A_2	A_3	A_4
P_1	([0.65,0.72],[0.21,0.28])	([0.63,0.75],[0.15,0.25])	([0.50,0.50],[0.50,0.50])	([0.55,0.60],[0.30,0.40])
P_2	([0.65,0.70],[0.25,0.30])	([0.55,0.60],[0.30,0.40])	([0.43,0.46],[0.51,0.54])	([0.24,0.35],[0.58,0.65])
P_3	([0.56,0.62],[0.30,0.38])	([0.36,0.42],[0.52,0.59])	([0.71,0.78],[0.17,0.22])	([0.31,0.42],[0.50,0.58])
P_4	([0.52,0.60],[0.35,0.41])	([0.59,0.65],[0.30,0.35])	([0.23,0.34],[0.58,0.66])	([0.19,0.30],[0.65,0.70])
P_5	([0.72,0.80],[0.15,0.20])	([0.38,0.45],[0.50,0.55])	([0.60,0.66],[0.30,0.34])	([0.73,0.80],[0.10,0.20])

Table 4: IVIF matrix by H_4.

	A_1	A_2	A_3	A_4
P_1	([0.17,0.22],[0.65,0.78])	([0.34,0.42],[0.50,0.58])	([0.59,0.66],[0.30,0.35])	([0.66,0.75],[0.20,0.25])
P_2	([0.32,0.40],[0.55,0.60])	([0.18,0.25],[0.70,0.75])	([0.57,0.62],[0.32,0.38])	([0.60,0.65],[0.30,0.35])
P_3	([0.43,0.47],[0.50,0.53])	([0.32,0.40],[0.55,0.60])	([0.68,0.75],[0.20,0.25])	([0.35,0.40],[0.55,0.60])
P_4	([0.32,0.39],[0.41,0.61])	([0.28,0.36],[0.57,0.64])	([0.41,0.52],[0.40,0.48])	([0.58,0.63],[0.30,0.37])
P_5	([0.25,0.30],[0.55,0.70])	([0.44,0.48],[0.50,0.52])	([0.74,0.80],[0.15,0.21])	([0.52,0.62],[0.32,0.38])

Table 5: IVIF matrix by H_5.

	A_1	A_2	A_3	A_4
P_1	([0.28,0.32],[0.60,0.68])	([0.34,0.41],[0.53,0.59])	([0.41,0.55],[0.37,0.45])	([0.69,0.75],[0.18,0.25])
P_2	([0.49,0.55],[0.40,0.45])	([0.27,0.34],[0.60,0.66])	([0.62,0.72],[0.20,0.28])	([0.39,0.45],[0.48,0.55])
P_3	([0.33,0.43],[0.51,0.57])	([0.59,0.65],[0.27,0.35])	([0.19,0.25],[0.19,0.25])	([0.26,0.32],[0.60,0.68])
P_4	([0.41,0.45],[0.50,0.55])	([0.40,0.45],[0.50,0.55])	([0.33,0.42],[0.50,0.58])	([0.34,0.41],[0.52,0.59])
P_5	([0.35,0.40],[0.50,0.60])	([0.46,0.55],[0.30,0.45])	([0.28,0.35],[0.58,0.65])	([0.57,0.67],[0.26,0.33])

4. Numerical Example and Some Comparative Analysis

4.1. Numerical Example. Some existing studies are based on the development of English teachers, on the basis of a new round of reform of the basic education curriculum evaluation requirements to measure compliance with foreign language teaching and learning to achieve the intended objectives, the analysis is presented in the experiment and some of the basic theory and practice. The core courses in the curriculum reform were implemented, and the fundamental way is to implement curriculum classroom. How to play the main channel function of the quality of education, curriculum reform which embodied the idea that each school and teachers are thinking about an important issue, reform of classroom assessment to classroom teaching scientific and effective evaluation, and the establishment of an effective evaluation mechanism should be the core of the curriculum reform issues or one important aspect because evaluation of reform often plays a guiding role, promoting or constraining role. According to current and future period for the reform and development of teaching, classroom assessment should be "developmental classroom evaluation." Class A is conducive to overcoming the limitations and deficiencies of current evaluation. It could reflect the latest trend of current teacher evaluation, advanced ideas and evaluation function, teacher reflection analysis, teacher future

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Table 6: Overall IVIF evaluation matrix.

	A_1	A_2	A_3	A_4
P_1	([0.4473,0.5186],[0.3847,0.4725])	([0.5266,0.4874],[0.2908,0.4054])	([0.4872,0.4706],[0.4123,0.4152])	([0.5354,0.4146],[0.4533,0.3644])
P_2	([0.3032,0.3588],[0.4872,0.6413])	([0.5627,0.3402],[0.3011,0.3549])	([0.5874,0.6826],[0.2512,0.3188])	([0.6571,0.7492],[0.2662,0.4506])
P_3	([0.3632,0.4297],[0.4241,0.5704])	([0.4122,0.4682],[0.3625,0.5312])	([0.5142,0.5862],[0.3421,0.4056])	([0.5233,0.5802],[0.3444,0.4176])
P_4	([0.4332,0.5057],[0.4272,0.4946])	([0.4769,0.5633],[0.3492,0.4303])	([0.3017,0.3643],[0.5678,0.4322])	([0.5315,0.3014],[0.3232,0.3967])
P_5	([0.4702,0.4165],[0.4312,0.4833])	([0.3062,0.4132],[0.5152,0.3890])	([0.4920,0.5554],[0.3651,0.4422])	([0.4082,0.3861],[0.3562,0.4165])

Table 7: The normalized IVIF matrix.

	A_1	A_2	A_3	A_4
P_1	([0.4473,0.5186],[0.3847,0.4725])	([0.2908,0.4054],[0.5266,0.4874])	([0.4872,0.4706],[0.4123,0.4152])	([0.5354,0.4146],[0.4533,0.3644])
P_2	([0.3032,0.3588],[0.4872,0.6413])	([0.3011,0.3549],[0.5627,0.3402])	([0.5874,0.6826],[0.2500,0.3188])	([0.6571,0.7492],[0.2662,0.4506])
P_3	([0.3632,0.4297],[0.4241,0.5704])	([0.3625,0.5312,[0.4122,0.4682]])	([0.5142,0.5862],[0.3421,0.4056])	([0.5233,0.5802],[0.3444,0.4176])
P_4	([0.4332,0.5057],[0.4272,0.4946])	([0.3492,0.4303],[0.4769,0.5633])	([0.3017,0.3643],[0.5678,0.4322])	([0.5315,0.3014],[0.3232,0.3967])
P_5	([0.4702,0.4165],[0.4312,0.4833])	([0.5152,0.3890],[0.3062,0.4132])	([0.4920,0.5554],[0.3651,0.4422])	([0.4082,0.3861],[0.3562,0.4165])

Table 8: The weights ta_j.

	A_1	A_2	A_3	A_4
w_j	0.1245	0.3564	0.3365	0.1736

Table 9: The GRC from IVIFPIS.

Alternatives	A_1	A_2	A_3	A_4
P_1	0.5737	1.0000	0.2286	0.5157
P_2	0.4326	0.5465	0.3095	0.6094
P_3	0.5984	0.7928	1.0000	1.0000
P_4	0.4037	0.6036	0.3294	0.5932
P_5	1.0000	0.5499	0.3083	0.6279

development potentiality, teacher classroom status, and value judgment process. However, the evaluation of teaching in the field of teaching is not only a worldwide problem but also the key to promoting quality education process. My current evaluation theory, methods and systems, and quality education are for the obvious gap. Evaluation of teachers teaching there are similar problems. These serious constraints restricted the promotion of quality education. Therefore, the establishment of the quality of classroom education development of the concept of evaluation system is the full implementation of the objective of quality education, while also teaching the design and implementation of our activities into a new stage. In this section, an empirical application is given evaluation to the English classroom teaching effect through IVIF-GRA. Since the school hopes to choose the best English teachers, there are five latent English teachers $P_i\,(i = 1, 2, 3, 4, 5)$. For evaluating the English classroom teaching effect fairly, five experts $H = \{H_1, H_2, H_3, H_4, H_5\}$ (expert's weight values w = (0.20, 0.20, 0.20, 0.20, 0.20) are asked. All invited experts express their evaluation through four given attributes: ① A1 is the teaching contents; ② A2 is the teaching cost; ③ A3 is the teaching atmosphere; ④ A4 is the teacher quality. Only A_2 is cost attribute.

Step 1: build the IVIF matrix $Q^{(k)} = (q_{ij}^{k})_{m\times n}$ as in Tables 1–5. Then, the overall matrix is derived in Table 6.

Step 2: normalize the IVIF matrix $Q = [_{q}^{ij}]_{m\times n}$ to $Q^N = [q_{ij}^N]_{m\times n}$ (see Table 7).

Step 3: obtain the given weights through CRITIC (see Table 8).

Step 4: determine IVIFPIS_j and IVIFNIS_j by using equations (12) and (13):

$$
\begin{aligned}
\text{IVIFPIS}_1 &= \langle [0.4702, 0.5186], [0.3847, 0.4725] \rangle,\\
\text{IVIFPIS}_2 &= \langle [0.5152, 0.5312], [0.3062, 0.3402] \rangle,\\
\text{IVIFPIS}_3 &= \langle [0.5874, 0.6826], [0.2500, 0.3188] \rangle,\\
\text{IVIFPIS}_4 &= \langle [0.6571, 0.7492], [0.2662, 0.3644] \rangle,\\
\text{IVIFNI}_1 &= \langle [0.3032, 0.3588], [0.4872, 0.6413] \rangle,\\
\text{IVIFNIS}_2 &= \langle [0.2908, 0.3890], [0.5627, 0.5633] \rangle,\\
\text{IVIFNIS}_3 &= \langle [0.3017, 0.3643], [0.5678, 0.4422] \rangle,\\
\text{IVIFNIS}_4 &= \langle [0.4082, 0.3014], [0.4533, 0.4506] \rangle.
\end{aligned} \tag{17}
$$

Step 5: figure out the GRC of every alternative from IVIFPIS and IVIFNIS (Tables 9 and 10).

Step 6: figure out the degree of GRC from IVIFPIS and IVIFNIS (Table 11).

Step 7: calculate IVIFRRD (ξ_i) from IVIFPIS (Table 12).

Step 8: According to IVIFRRD (ξ_i), the higher IVIFRRD (ξ_i), the better the alternative. Thus, the order is $P_3 > P_1 > P_5 > P_4 > P_2$ and P_3 is the best one.

4.2. Compare Analysis. The designed method is always compared with four methods to show the superiority. Firstly, make a comparison between our designed method with IVIFWA and IVIFWG operator. For IVIFWA operator, the calculating value is $S(P_1) = 0.5771$, $S(P_2) = 0.4623$, $S(P_3) = 0.6146$, $S(P_4) = 0.4988$, and $S(P_5) = 0.5409$. Thus, the

Table 10: The GRC from IVIFNIS.

Alternatives	A_1	A_2	A_3	A_4
P_1	0.4070	1.0000	0.3062	0.5654
P_2	0.6796	0.1100	0.8900	0.9476
P_3	0.3421	0.4755	1.0000	0.5063
P_4	0.8900	0.6298	0.6027	1.0000
P_5	1.0000	0.5639	0.3764	0.5839

Table 11: IVIFPIS (ξ_i) and IVIFNIS (ξ_i).

Alternatives	IVIFPIS (ξ_i)	IVIFNIS (ξ_i)
P_1	0.6952	0.5441
P_2	0.6087	1.0676
P_3	0.9825	0.5037
P_4	0.6154	0.8752
P_5	0.7577	0.6138

Table 12: The IFRRD from IFPIS.

Alternatives	P_1	P_2	P_3	P_4	P_5
IVIFRRD (ξ_i)	0.4236	0.1742	0.5371	0.2384	0.4042

Table 13: The compared results of other methods.

Models	Order	The best choice	The worst choice
IVIFWA[68]	$P_3 > P_1 > P_5 > P_4 > P_2$	P_3	P_2
IVIFWG [68]	$P_3 > P_1 > P_5 > P_4 > P_2$	P_3	P_2
IVIF-CODAS [75]	$P_3 > P_1 > P_5 > P_4 > P_2$	P_3	P_2
The built method	$P_3 > P_1 > P_5 > P_4 > P_2$	P_3	P_2

ranking order is $P_3 > P_1 > P_5 > P_4 > P_2$. For IVIFWG operator, the order is $S(P_1) = 0.5525$, $S(P_2) = 0.4411$, $S(P_3) = 0.6156$, $S(P_4) = 0.4988$, and $S(P_5) = 0.5322$. The order is $P_3 > P_1 > P_5 > P_4 > P_2$.

Finally, our method is compared with IVIF-CODAS [75]. The total assessment score is $AS_1 = 0.9041$, $AS_2 = -1.4527$, $AS_3 = 1.5382$, $AS_4 = -1.018$, and $AS_5 = 0.6395$. Therefore, the order is $P_3 > P_1 > P_5 > P_4 > P_2$.

The results of four methods are shown in Table 13.

5. Conclusion

Life changes and people's ideas and educational expectation have brought great challenges to contemporary school education, especially to English education. With the gradual development of social needs, schools seem hard to meet the more and more advanced and complex education needs of the society. In order to promote whole-person education to students, family-school cooperation has become one of the effective ways to collect common effort and establish collaboration for education. Family and school cooperation not only provides an opportunity for in-depth development by prioritizing education environment and exploring potentiality of education resources but also is a booster for the development of students' physical and mental health. However, while there are achievements in family-school cooperative management, there are still difficulties and problems. And the theoretical basis and teaching practices need further exploration. Affordance theory proposed by Gibson [76] claims that there is an interaction between humans (individuals)and the environment (the nature). There is potentiality of potential act in the affordance environment. Its existence is closely related to actors' capability and understanding of the environment. That is to say, affordance is characterized not only by the environment but also by the individuals and emerges only when the two factors interact. Generally, we may put our focus on the affordance of language, the affordance of social culture, and the affordance of situations. Although focal difference exists between these types of affordances, there are similarities. Classroom management can be considered as an environment created together by the child, the teacher, and the parents, as compared with the traditional classroom management, which put emphasis on the interactive rule of the teacher and the student and the environment managed by the teacher. However, parents' participation in English class management provides a possible route for affordable learning environment. This study builds the useful method for this kind of given issue since it builds the IVIF-GRA method for English classroom teaching effect evaluation. And then, a numerical example gives evaluation to English classroom teaching effect. Furthermore, some useful comparative analysis is also given. The main contributions of such study are outlined: (1) the GRA algorithm is used to deal with MAGDM issue under IVIFSs, (2) the weights are derived through CRITIC model, (3) a numerical example for English classroom teaching effect evaluation is given, and (4) some comparative studies are given. At the same time, the main limitations of such study are outlined: (1) the built GRA method does not consider influence of DMs' psychological factors on the given decision result under IVIFSs; (2) the weights of attribute do not consider subjective weight information.

In the near future, we shall pay attention to the consensus reaching process and how to deal with the situations when criteria weights are incompletely known [77–82].

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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