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An approach to evaluating the quality of physical education in universal institutions of higher learning

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ABSTRACT

In this paper, we investigate the multiple attribute group decision making (MAGDM) problems for for evaluating the quality of public physical education in universal institutions of higher learning with 2-tuple linguistic Information. Then, a model based on the 2-tuple ordered weighted geometric (TOWG) and 2-tuple weighted geometric (TWG) operators to evaluate the quality of public physical education in universal institutions of higher learning is presented. In this model, alternative appraisal values are calculated by the aggregation of 2-tuple linguistic information. Thus, the ranking of alternative or selection of the most desirable trip (s) is obtained by the comparison of 2-tuple linguistic information. Finally, an illustrative example about risk investment is given to verify the developed approach and to demonstrate its practicality and effectiveness.

KEYWORDS

Multiple attribute group decision-making (MAGDM); 2-tuple ordered weighted geometric (TOWG) operator, 2-tuple linguistic information, Quality education.

INTRODUCTION

The human society has just entered the 21st century, a historical period when our country is undergoing tremendous and profound changes, and also a historical period that provides us with new opportunities and challenges -how colleges and universities will deepen their reform in college PE so as to meet the requirement for quality education as well as need for "life PE". It has set problems for college PE teacher to consider seriously and answer correctly. The reform and development in college PE in institutions of higher learning demand that the traditional PE instructive thinking be revolutionized or "yang qi" as called in philosophy. How to correctly evaluate the teaching quality of college PE class is an urgent problem to be resolved at present in theory and practice. But now, in our country, there is not better theory or methods to evaluate teaching quality of PE class, which has been brought on by history and which hinder the improvement of the teaching quality and the management of the teachers. How to correctly understand the teaching evaluation of college PE class, to formulate a full theoretical system of the teaching evaluation of college PE class, to probe the scientific method and technology of PE teaching evaluation-all these problems are worth concerning in the reform and practice. In this article the author analyzes and discusses objectively some important realistic and theoretical problems faced by college PE lesson in the new century under the ideas of materialism and the principle of seeking truth from facts. The author uses PE psychology, PE-managing science, scholastic PE science, public PE science, fuzzy mathematics, PE teaching theory as well as theory and method of education evaluation to study the problems of how to found a system of evaluating PE class quality in the colleges in the new situation, how to establish evaluation index "weight" and how to design methods of evaluation.

The problem of evaluating the quality of public physical education in universal institutions of higher learning with 2-tuple linguistic information is the multiple attribute group decision making (MAGDM) problems[1-10]. The aim of this paper is to investigate the MAGDM problems for evaluating the quality of public physical education in universal institutions of higher learning with 2-tuple linguistic information. The remainder of this paper is set out as follows. In the next section, we introduce some basic concepts related to2-tuple linguistic information s. In Section 3 we introduce the MAGDM problem deal with appraisal model of the quality of public physical education in universal institutions of higher learning with 2-tuple linguistic information. Then, a model based on the 2-tuple ordered weighted geometric (TOWG) and 2-tuple weighted geometric (TWG) operators to evaluate the quality of public physical education in universal institutions of higher learning is presented. In this model, alternative appraisal values are calculated by the aggregation of 2-tuple linguistic information. Thus, the ranking of alternative or selection of the most desirable trip (s) is obtained by the comparison of 2-tuple linguistic information. In Section 4, an illustrative example is pointed out. In Section 5 we conclude the paper and give some remarks.

PRELIMINARIES

Let $S = \{ s_i | i = 1, 2, \cdots, t \}$ be a linguistic term set with odd cardinality. Any label, s_i represents a possible value for a linguistic variable, and it should satisfy the following characteristics[11-15]:

(1) The set is ordered: $s_i > s_j$, if $i > j$; (2) Max operator: $\max(s_i, s_j) = s_i$, if $s_i \geq s_j$; (3) Min operator: $\min(s_i, s_j) = s_i$, if $s_i \leq s_j$. For example, S can be defined as

$$\begin{aligned} S = \{ & s_1 = extremely\ poor, s_2 = very\ poor, s_3 = poor, s_4 = medium, \\ & s_5 = good, s_6 = very\ good, s_7 = extremely\ good \} \end{aligned}$$

Definition 1. Let $S = \{ s_1, s_2, \cdots, s_t \}$ be a linguistic term set and $\beta \in [1, t]$ be a value representing the result of a symbolic aggregation operation; then 2-tuple that expresses the equivalent information to β is obtained with the following function:

$$\Delta\ [1, t] \to S \times [-0.5, 0.5) \quad \textbf{(1)}$$

$$\Delta(\beta) = \begin{cases} s_i, i = round(\beta) \\ \alpha = \beta - i,\ \alpha \in [-0.5, 0.5) \end{cases} \quad \textbf{(2)}$$

where round (.) is the usual round operation, s_i has the closest index label to β and α is the value of the symbolic translation[11-15].

Definition 2. Let $S=\{s_1,s_2,\cdots,s_t\}$ be a linguistic term set and (s_i,α_i) be a 2-tuple; a function Δ^{-1} can be defined, such that, from a 2-tuple (s_i,α_i) it return its equivalent numerical value $\beta\in[1,t]\subset R$, which is obtained with the following function[11-15]:

$$\Delta^{-1}:\ S\times[-0.5,0.5)\to[1,t] \tag{3}$$

$$\Delta^{-1}(s_i,\alpha)=i+\alpha=\beta \tag{4}$$

Definition 3[16]. Let $x=\{(r_1,a_1),(r_2,a_2),\ldots,(r_n,a_n)\}$ be a set of 2-tuple and $\omega=(\omega_1,\omega_2,\cdots,\omega_n)^T$ be the weighting vector of 2-tuple (r_j,a_j) $(j=1,2,\cdots,n)$ and $\omega_j\in[0,1]$, $\sum_{j=1}^{n}\omega_j=1$, The 2-tuple weighted geometric operator is

$$(\tilde{r},\tilde{a})=TWG_\omega((r_1,a_1),(r_2,a_2),\ldots,(r_n,a_n))=\Delta\left(\prod_{j=1}^{n}\left(\Delta^{-1}(r_j,a_j)\right)^{\omega_j}\right)$$

$$\tilde{r}\in S,\tilde{a}\in[-0.5,0.5) \tag{5}$$

Definition 4[16]. Let $x=\{(r_1,a_1),(r_2,a_2),\ldots,(r_n,a_n)\}$ be a set of 2-tuple, A 2-tuple ordered weighted geometric operator of dimension n is a mapping $TOWG:R^n\to R$ that has an associated vector $w=(w_1,w_2,\cdots,w_n)^T$ such that $w_j>0$ and $\sum_{j=1}^{n}w_j=1$. Furthermore,

$$(\hat{r},\hat{a})=\mathrm{TOWG_w}((r_1,a_1),(r_2,a_2),\ldots,(r_n,a_n))$$

$$=\Delta\left(\prod_{j=1}^{n}\left(\Delta^{-1}(r_{\sigma(j)},a_{\sigma(j)})\right)^{w_j}\right),\hat{r}\in S,\hat{a}\in[-0.5,0.5) \tag{6}$$

where $(\sigma(1),\sigma(2),\cdots,\sigma(n))$ is a permutation of $(1,2,\cdots,n)$, such that $(r_{\sigma(j-1)},a_{\sigma(j-1)})\geq(r_{\sigma(j)},a_{\sigma(j)})$ for all $j=2,\cdots,n$.

AN APPROACH TO EVALUATING THE QUALITY OF PHYSICAL EDUCATION IN UNIVERSAL INSTITUTIONS OF HIGHER LEARNING

The following assumptions or notations are used to represent the MAGDM problems for evaluating quality of public physical education in universal institutions of higher learning with 2-tuple linguistic information. Let $A=\{A_1,A_2,\cdots,A_m\}$ be a discrete set of alternatives, and $G=\{G_1,G_2,\cdots,G_n\}$ be the set of attributes, $\omega=(\omega_1,\omega_2,\cdots,\omega_n)$ is the weighting vector of the attributes G_j $(j=1,2,\cdots,n)$, where $\omega_j\geq 0$, $j=1,2,\cdots,n$, $\sum_{j=1}^{n}\omega_j=1$. Let $D=\{D_1,D_2,\cdots,D_t\}$ be the set of decision makers. Suppose that $\tilde{R}_k=\left(\tilde{r}_{ij}^{(k)}\right)_{m\times n}$ is the decision matrix, where $\tilde{r}_{ij}^{(k)}\in\tilde{S}$ is a preference value, which takes the form of linguistic variables, given by the decision maker $D_k\in D$, for the alternative $A_i\in A$ with respect to the attribute $G_j\in G$. Let $A=\{A_1,A_2,\cdots,A_m\}$ be a discrete set of alternatives.

In the following, we apply the proposed model to MAGDM for evaluating the quality of public physical education in universal institutions of higher learning with 2-tuple linguistic information.

Step 1. Transforming linguistic decision matrix $R_k = \left(r_{ij}^{(k)}\right)_{m\times n}$ into 2-tuple linguistic decision matrix $R_k = \left(r_{ij}^{(k)}, 0\right)_{m\times n}$.

Step 2. Utilize the decision information given in matrix R_k, and the TWG operator

$$z_i^{(k)} = \left(r_i^{(k)}, a_i^{(k)}\right) = \Delta\left(\prod_{j=1}^{n}\left(\Delta^{-1}\left(r_{ij}^{(k)}, 0\right)\right)^{\omega_j}\right), r_i^{(k)} \in S, a_i^{(k)} \in [-0.5, 0.5) \quad \textbf{(7)}$$

to derive the individual overall preference value $\tilde{r}_i^{(k)}$ of the alternative A_i.

Step 3. Utilize the TOWG operator:

$$z_i = \left(r_i, a_i\right) = \Delta\left(\prod_{k=1}^{t}\left(\Delta^{-1}\left(\hat{r}_i^{\sigma(k)}, \hat{a}_i^{\sigma(k)}\right)\right)^{\nu_k}\right), r_i \in S, a_i \in [-0.5, 0.5) \quad \textbf{(8)}$$

to derive the collective overall preference values $z_i = \left(r_i, a_i\right)\left(i = 1, 2, \cdots, m\right)$ of the alternative A_i, where $\left(\hat{r}_i^{\sigma(k)}, \hat{a}_i^{\sigma(k)}\right)$ is the k-th largest of the 2-tuple linguistic weighted arguments $\left(r_i^{(k)}, a_i^{(k)}\right)\left(k = 1, 2, \cdots, t\right)$, $\nu = \left(\nu_1, \nu_2, \cdots, \nu_n\right)$ is the associated 2-tuple linguistic weighting vector of the TOWG operator, $\nu_k \geq 0$, $j = 1, 2, \cdots, n$, $\sum_{j=1}^{n}\nu_k = 1$.

Step 4. Rank all the alternatives $A_i\left(i = 1, 2, \cdots, m\right)$ and select the best one (s) in accordance with $z_i\left(i = 1, 2, \cdots, m\right)$. If any alternative has the highest z_i value, then, it is the most important alternative.

Step 5. End.

NUMERICAL EXAMPLE

This section presents a numerical example to illustrate the method proposed in this paper. Suppose a school plans to evaluate physical education teaching effectiveness. There is a panel with four possible physical education teachers $T_i\left(i = 1, 2, 3, 4\right)$ to select. The school selects five attribute to evaluate the four possible physical education teachers: □G_1 is the students' assessment; □G_2 is peers' assessment; □G_3 is the experts' assessment; □G_4 is the leadership's assessment; □sports scores. The four possible physical education teachers $T_i\left(i = 1, 2, 3, 4\right)$ are to be evaluated using the linguistic term set

$$\begin{aligned} S = \{ & s_1 = extremely\ poor, s_2 = very\ poor, s_3 = poor, s_4 = medium, \\ & s_5 = good, s_6 = very\ good, s_7 = extremely\ good\} \end{aligned}$$

by the three decision makers $D_k\left(k = 1, 2, 3\right)$ under the above five attributes whose weighting vector $\omega = \left(0.25, 0.15, 0.30, 0.20, 0.10\right)^T$), and construct, respectively, the decision matrices as follows $\tilde{R}_k = \left(\tilde{r}_{ij}^{(k)}\right)_{5\times 4}\left(k = 1, 2, 3\right)$:

$$\tilde{R}_1 = \begin{array}{c} T_1 \\ T_2 \\ T_3 \\ T_4 \end{array}\begin{pmatrix} s_3 & s_4 & s_4 & s_2 & s_2 \\ s_4 & s_6 & s_3 & s_2 & s_3 \\ s_5 & s_5 & s_5 & s_7 & s_7 \\ s_3 & s_4 & s_6 & s_3 & s_1 \end{pmatrix}$$

$$\tilde{R}_2 = \begin{array}{c} T_1 \\ T_2 \\ T_3 \\ T_4 \end{array} \begin{pmatrix} s_2 & s_1 & s_3 & s_4 & s_4 \\ s_5 & s_2 & s_2 & s_1 & s_3 \\ s_6 & s_4 & s_6 & s_5 & s_3 \\ s_2 & s_6 & s_7 & s_2 & s_2 \end{pmatrix}$$

$$\tilde{R}_3 = \begin{array}{c} T_1 \\ T_2 \\ T_3 \\ T_4 \end{array} \begin{pmatrix} s_2 & s_1 & s_5 & s_3 & s_4 \\ s_3 & s_4 & s_2 & s_5 & s_3 \\ s_5 & s_5 & s_6 & s_7 & s_4 \\ s_7 & s_7 & s_5 & s_6 & s_2 \end{pmatrix}$$

In the following, we shall utilize the proposed approach in this paper getting the most desirable teacher (s):

Step 1. Transforming linguistic decision matrix $R_k = \left(r_{ij}^{(k)}\right)_{m\times n}$ into 2-tuple linguistic decision matrix $R_k = \left(r_{ij}^{(k)}, 0\right)_{m\times n}$ as follows

$$\tilde{R}_1 = \begin{pmatrix} (s_3,0) & (s_4,0) & (s_4,0) & (s_2,0) & (s_2,0) \\ (s_4,0) & (s_6,0) & (s_3,0) & (s_2,0) & (s_3,0) \\ (s_5,0) & (s_5,0) & (s_5,0) & (s_7,0) & (s_7,0) \\ (s_3,0) & (s_4,0) & (s_6,0) & (s_3,0) & (s_1,0) \end{pmatrix}$$

$$\tilde{R}_2 = \begin{pmatrix} (s_2,0) & (s_1,0) & (s_3,0) & (s_4,0) & (s_4,0) \\ (s_5,0) & (s_2,0) & (s_2,0) & (s_1,0) & (s_3,0) \\ (s_6,0) & (s_4,0) & (s_6,0) & (s_5,0) & (s_3,0) \\ (s_2,0) & (s_6,0) & (s_7,0) & (s_2,0) & (s_2,0) \end{pmatrix}$$

$$\tilde{R}_3 = \begin{pmatrix} (s_2,0) & (s_1,0) & (s_5,0) & (s_3,0) & (s_4,0) \\ (s_3,0) & (s_4,0) & (s_2,0) & (s_5,0) & (s_3,0) \\ (s_5,0) & (s_5,0) & (s_6,0) & (s_7,0) & (s_4,0) \\ (s_7,0) & (s_7,0) & (s_5,0) & (s_6,0) & (s_2,0) \end{pmatrix}$$

Step 2. Utilize the decision information given in matrix $\tilde{R}_k$, and the TWG operator to derive the individual overall preference value $z_i^{(k)} = \left(r_i^{(k)}, a_i^{(k)}\right)$ of the teacher A_i.

$$z_1^{(1)} = (s_3, 0.02), z_2^{(1)} = (s_3, 0.30), z_3^{(1)} = (s_6, -0.47), z_4^{(1)} = (s_5, 0.41)$$
$$z_1^{(2)} = (s_3, -0.24), z_2^{(2)} = (s_3, 0.07), z_3^{(2)} = (s_6, -0.48), z_4^{(2)} = (s_3, 0.46)$$
$$z_1^{(3)} = (s_3, -0.49), z_2^{(3)} = (s_2, 0.28), z_3^{(3)} = (s_5, 0.08), z_4^{(3)} = (s_3, 0.43)$$

Step 3. Utilize the TOWG operator to derive the collective overall preference values $z_i = (r_i, a_i)\ (i = 1,2,3,4)$ of the teacher A_i, $w = (0.2, 0.5, 0.3)$ is the associated weighting vector of the TOWG operator.

$$z_1 = (s_3, -0.27), z_2 = (s_3, -0.15), z_3 = (s_5, 0.39), z_4 = (s_4, -0.23)$$

Step 4. Ranking all the teachers $T_i\ (i = 1, 2, 3, 4)$ in accordance with the $z_i\ (i = 1, 2, 3, 4): T_3 \succ T_4 \succ T_2 \succ T_1$, and thus the most desirable teacher is T_3.

CONCLUSION

In this paper, we investigate the multiple attribute group decision making (MAGDM) problems for for evaluating the quality of public physical education in universal institutions of higher learning with 2-tuple linguistic Information. Then, a model based on the 2-tuple ordered weighted geometric (TOWG) and 2-tuple weighted geometric (TWG) operators to evaluate the quality of public physical education in universal institutions of higher learning is presented. In this model, alternative appraisal values are calculated by the aggregation of 2-tuple linguistic information. Thus, the ranking of alternative or selection of the most desirable trip (s) is obtained by the comparison of 2-tuple linguistic information. Finally, an illustrative example for evaluating the quality of physical education in universal institutions is given to verify the developed approach and to demonstrate its practicality and effectiveness.

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