ISSN : 0974 - 7435 Volume 10 Issue 12

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(12), 2014 [6701-6706]

Research on the comprehensive evaluation of physical education teaching and sports training with interval-valued intuitionistic fuzzy information

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ABSTRACT

In this paper, we investigate the multiple attribute decision making problems for evaluating the physical education teaching and sports training with interval-valued intuitionistic fuzzy information. Some operational laws of interval-valued intuitionistic fuzzy numbers, score functions and accuracy function of interval-valued intuitionistic fuzzy numbers are introduced. Based on these operational laws, we used interval-valued intuitionistic fuzzy Hamacher weighted geometric (IVIFHWG) operator to evaluate the physical education teaching and sports training. Finally, an illustrative example is given to verify the developed approach.

KEYWORDS

Comprehensive evaluation; Multiple attribute decision making; Interval-valued intuitionistic fuzzy information; Interval-valued intuitionistic fuzzy hamacher weighted geometric (ivifhwg) operator; Physical education teaching and sports training.

INTRODUCTION

Teachers teaching students skills to become a qualified teacher must possess the basic qualities, is a teacher of teachers to implement and control the entire process of teaching the basic ability is successful in teaching a series of effective teaching goal behavior. Teaching ability of teachers will have a direct impact on teaching. Present in a wide range of internationally recognized training in teaching skills is micro teaching, which normal students in the classroom culture have a terrific ability to effect. Therefore, micro teaching of how to cultivate and improve the teaching ability of normal students, as soon as possible between the normal students and prospective teachers the role of conversion, to adapt to social, national, education, work unit and individual self-development needs, is the Normal School education to realize their own responsibilities and problems to be solved. However, the use of teaching skills, microteaching training methods or organizational forms under different requirements in different, but either the results of variant final evaluation of whether they are normal students to improve the standard of teaching skills. Education, psychology, physical education theory, behaviorism, cybernetics and systems theory and other basic principle of modern science, through the collection of relevant information, visit the expert teachers, questionnaires, teaching experiments carried out to expand this study Work. Decomposition under the microteaching skills training theory and skills training method even into the style to basketball practice teaching organizational skills training as an example test Microteaching Microteaching experiments. The statistics, identified six Basketball Students must master the teaching skills. After the end of each skills training the experimental group and control group tests the training effect, and gives the test scores. Statistical treatment of post-test scores showed that: The main line role-playing skills training methods in the form of physical exercise as the main effect of training in teaching skills than the Sichuan Institute of Physical Education Teachers currently using the "one-man show" type of Micro Training PE Students in a short time to improve the teaching skills an advantage; in the language as the main form of teaching skills training, both of which no significant difference between the training effect. But the "one-man show" type of training methods of its organization is simple, take a relatively shorter time. Therefore, the two training methods in sports practice classroom skills training classes can be targeted to use.

In this paper, we investigate the multiple attribute decision making problems[1-4] for evaluating the physical education teaching and sports training with interval-valued intuitionistic fuzzy information. Some operational laws of interval-valued intuitionistic fuzzy numbers, score functions and accuracy function of interval-valued intuitionistic fuzzy numbers are introduced. Based on these operational laws, we used interval-valued intuitionistic fuzzy Hamacher weighted geometric (IVIFHWG) operator to evaluate the physical education teaching and sports training. Finally, an illustrative example is given to verify the developed approach.

PRELIMINARIES

Atanassov and Gargov[5-6] introduced the interval-valued intuitionistic fuzzy set (IVIFS), which is a generalization of the IFS.

Definition 1[5-6]. Let X be a universe of discourse, An IVIFS $\tilde{A}$ over X is an object having the form:

$$\tilde{A}=\left\{\left\langle x,\tilde{\mu}_A(x),\tilde{\nu}_A(x)\right\rangle\middle|x\in X\right\} \quad \textbf{(1)}$$

where $\tilde{\mu}_A(x)\subset[0,1]$ and $\tilde{\nu}_A(x)\subset[0,1]$ are interval numbers, and $0\le\sup\left(\tilde{\mu}_A(x)\right)+\sup\left(\tilde{\nu}_A(x)\right)\le 1,\forall\, x\in X$.

Definition 2. Let $\tilde{a}=\left(\left[a,b\right],\left[c,d\right]\right)$ be the interval-valued intuitionistic fuzzy number, its score function S can be represented as follows[7-9]:

$$S\left(\tilde{a}\right)=\frac{a-c+b-d}{2},\quad S\left(\tilde{a}\right)\in\left[-1,1\right] \tag{2}$$

Definition 3. Let $\tilde{a}=\left(\left[a,b\right],\left[c,d\right]\right)$ be the interval-valued intuitionistic fuzzy number, its accuracy function H can be represented as follows[7-9]:

$$H\left(\tilde{a}\right)=\frac{a+b+c+d}{2},\quad H\left(\tilde{a}\right)\in\left[0,1\right] \tag{3}$$

to evaluate the degree of accuracy of the interval-valued intuitionistic fuzzy value. The larger the value of $H\left(\tilde{a}\right)$, the more the degree of accuracy of the interval-valued intuitionistic fuzzy value $\tilde{a}$.

Liu[10] investigated the interval-valued intuitionistic fuzzy geometric aggregation operators with the help of the Hamacher operations.

Definition 4[10]. Let $\tilde{a}_j=\left(\left[a_j,b_j\right],\left[c_j,d_j\right]\right)\ \left(j=1,2,\cdots,n\right)$ be the collection of interval-valued intuitionistic fuzzy values, and let IVIFHWG: $Q^n\to Q$, if

$$\begin{aligned}&\mathrm{IVIFHWG}_{\omega}\left(\tilde{a}_1,\tilde{a}_2,\cdots,\tilde{a}_n\right)=\bigotimes_{j=1}^{n}\left(\tilde{a}_j\right)^{\omega_j}\\&=\left(\left[\frac{\gamma\prod_{j=1}^{n}a_j{}^{\omega_j}}{\prod_{j=1}^{n}\left(1+\left(\gamma-1\right)\left(1-a_j\right)\right)^{\omega_j}+\left(\gamma-1\right)\prod_{j=1}^{n}a_j{}^{\omega_j}},\frac{\gamma\prod_{j=1}^{n}b_j{}^{\omega_j}}{\prod_{j=1}^{n}\left(1+\left(\gamma-1\right)\left(1-b_j\right)\right)^{\omega_j}+\left(\gamma-1\right)\prod_{j=1}^{n}b_j{}^{\omega_j}}\right],\right.\\&\left.\left[\frac{\prod_{j=1}^{n}\left(1+\left(\gamma-1\right)c_j\right)^{\omega_j}-\prod_{j=1}^{n}\left(1-c_j\right)^{\omega_j}}{\prod_{j=1}^{n}\left(1+\left(\gamma-1\right)c_j\right)^{\omega_j}+\left(\gamma-1\right)\prod_{j=1}^{n}\left(1-c_j\right)^{\omega_j}},\frac{\prod_{j=1}^{n}\left(1+\left(\gamma-1\right)d_j\right)^{\omega_j}-\prod_{j=1}^{n}\left(1-d_j\right)^{\omega_j}}{\prod_{j=1}^{n}\left(1+\left(\gamma-1\right)d_j\right)^{\omega_j}+\left(\gamma-1\right)\prod_{j=1}^{n}\left(1-d_j\right)^{\omega_j}}\right]\right)\end{aligned} \tag{4}$$

where $\omega=\left(\omega_1,\omega_2,\cdots,\omega_n\right)^T$ be the weight vector of $\tilde{a}_j\left(j=1,2,\cdots,n\right)$, and $\omega_j>0$, $\sum_{j=1}^{n}\omega_j=1$, then IVIFHWG is called the interval-valued intuitionistic fuzzy Hamacher weighted geometric (IVIFHWG) operator.

RESEARCH ON THE COMPREHENSIVE EVALUATION OF PHYSICAL EDUCATION TEACHING AND SPORTS TRAINING WITH INTERVAL-VALUED INTUITIONISTIC FUZZY INFORMATION

In this section, we shall develop an approach based on the interval-valued intuitionistic fuzzy Hamacher weighted geometric (IVIFHWG) operator to evaluate the physical education teaching and sports training with interval-valued intuitionistic fuzzy information as follows. Suppose that $\tilde{R}=\left(\tilde{r}_{ij}\right)_{m\times n}=\left(\left[a_{ij},b_{ij}\right],\left[c_{ij},d_{ij}\right]\right)_{m\times n}$ is the interval-valued intuitionistic fuzzy decision matrix, where

$\left[a_{ij}, b_{ij}\right]$ indicates the degree that the alternative A_i satisfies the attribute G_j given by the decision maker, $\left[c_{ij}, d_{ij}\right]$ indicates the degree that the alternative A_i doesn't satisfy the attribute G_j given by the decision maker, $\left[a_{ij}, b_{ij}\right] \subset [0,1]$, $\left[c_{ij}, d_{ij}\right] \subset [0,1]$, $b_{ij} + d_{ij} \le 1$, $i = 1, 2, \cdots, m$, $j = 1, 2, \cdots, n$.

In the following, we apply the interval-valued intuitionistic fuzzy Hamacher weighted geometric (IVIFHWG) operator to evaluate the physical education teaching and sports training with interval-valued intuitionistic fuzzy information.

Step 1. Utilize the decision information given in the interval-valued intuitionistic fuzzy decision matrix $\tilde{R}$, and the interval-valued intuitionistic fuzzy Hamacher weighted geometric (IVIFHWG) operator operator

$$\tilde{r}_i = \mathrm{IVIFHWG}_{\omega}\left(\tilde{r}_{i1}, \tilde{r}_{i2}, \cdots, \tilde{r}_{in}\right) = \bigotimes_{j=1}^{n}\left(\tilde{r}_{ij}\right)^{\omega_j}$$

$$= \left(\left[\frac{\gamma \prod_{j=1}^{n} a_{ij}^{\ \omega_j}}{\prod_{j=1}^{n}\left(1+(\gamma-1)\left(1-a_{ij}\right)\right)^{\omega_j} + (\gamma-1)\prod_{j=1}^{n} a_{ij}^{\ \omega_j}}, \frac{\gamma \prod_{j=1}^{n} b_{ij}^{\ \omega_j}}{\prod_{j=1}^{n}\left(1+(\gamma-1)\left(1-b_{ij}\right)\right)^{\omega_j} + (\gamma-1)\prod_{j=1}^{n} b_{ij}^{\ \omega_j}} \right], \right.$$

$$\left. \left[\frac{\prod_{j=1}^{n}\left(1+(\gamma-1)c_{ij}\right)^{\omega_j} - \prod_{j=1}^{n}\left(1-c_{ij}\right)^{\omega_j}}{\prod_{j=1}^{n}\left(1+(\gamma-1)c_{ij}\right)^{\omega_j} + (\gamma-1)\prod_{j=1}^{n}\left(1-c_{ij}\right)^{\omega_j}}, \frac{\prod_{j=1}^{n}\left(1+(\gamma-1)d_{ij}\right)^{\omega_j} - \prod_{j=1}^{n}\left(1-d_{ij}\right)^{\omega_j}}{\prod_{j=1}^{n}\left(1+(\gamma-1)d_{ij}\right)^{\omega_j} + (\gamma-1)\prod_{j=1}^{n}\left(1-d_{ij}\right)^{\omega_j}} \right] \right)$$

to derive the overall preference interval-valued intuitionistic fuzzy value $\tilde{r}_i$ of the schools A_i.

Step 2. Calculate the scores $S\left(\tilde{r}_i\right)\left(i = 1, 2, \cdots, m\right)$ of the overall interval-valued intuitionistic fuzzy preference values $\tilde{r}_i\ \left(i = 1, 2, \cdots, m\right)$ to rank all the schools $A_i\left(i = 1, 2, \cdots, m\right)$ and then to select the best one (s).

Step 3. Rank all the schools $A_i\left(i = 1, 2, \cdots, m\right)$ and select the best one (s) in accordance with $S\left(\tilde{r}_i\right)$ and $H\left(\tilde{r}_i\right)\left(i = 1, 2, \cdots, m\right)$.

NUMERICAL EXAMPLE

As for now, the development of Outward Bound in the physical education, largely focused on the possibility, study status, development trend and its psychological impact. The shortcoming of today's Outward Bound in physical education. Participation: compared with other types of physical education, Outward Bound can be more attractive, and can make students be more active and willing to take part in. during Outward Bound, dominant position of students is very import, and it closely related with the result of education. The entire education design is based on student's psychological need, so students can get the driving force to be involved in the training. The teacher's role is reflected in the scene layout, guiding, instructing and supervising. Students are the dominant part and teacher play assistant role. Training skills: The acquisition and improvement of physical skills need constant repeating, but Outward Bound need no more repeating. Outward Bound does not need sports technology, its operation does not require teachers' specialized sports teaching. The selection of the training is cautious and normally don't need specialized technology. Physical health: the selection of projects is based on the preliminary survey of students' mental situation and their physical ability to complete the items. ②the project have little impact on students' physical fitness, due to its lack of repeating. Mental health: From

beginning to the end, the process of Outward Bound is focused on the feeling of students. So, sometimes, psychological teachers can be more professional. This section presents a numerical example to evaluate the physical education teaching and sports training with interval-valued intuitionistic fuzzy information to illustrate the method proposed in this paper. There is a panel with five possible schools $A_i\ (i=1,2,\cdots,5)$ to evaluate. The education institution must take a decision according to the following four attributes: G_1 is the sports basic theoretical knowledge evaluation; G_2 is the physical fitness and sports skill evaluation; G_3 is the learning attitude evaluation; G_4 is the affective expression. The five possible schools $A_i\ (i=1,2,\cdots,5)$ are to be evaluated using the interval-valued intuitionistic fuzzy set by the decision makers under the above four attributes, and construct the decision matrix as follows $\tilde{R}=\left(\tilde{r}_{ij}\right)_{5\times 4}$:

$$\tilde{R}=\begin{bmatrix}
([0.4,0.5],[0.3,0.4]) & ([0.4,0.6],[0.2,0.4]) \\
([0.5,0.6],[0.2,0.3]) & ([0.6,0.7],[0.2,0.3]) \\
([0.3,0.5],[0.3,0.4]) & ([0.1,0.3],[0.5,0.6]) \\
([0.2,0.5],[0.3,0.4]) & ([0.4,0.7],[0.1,0.2]) \\
([0.3,0.4],[0.1,0.3]) & ([0.7,0.8],[0.1,0.2])
\end{bmatrix}$$

$$\begin{bmatrix}
([0.3,0.4],[0.4,0.5]) & ([0.5,0.6],[0.1,0.3]) \\
([0.5,0.6],[0.3,0.4]) & ([0.4,0.7],[0.1,0.2]) \\
([0.2,0.5],[0.4,0.5]) & ([0.2,0.3],[0.4,0.6]) \\
([0.4,0.5],[0.3,0.5]) & ([0.5,0.8],[0.1,0.2]) \\
([0.5,0.6],[0.2,0.4]) & ([0.6,0.7],[0.1,0.2])
\end{bmatrix}$$

Then, we utilize the approach developed to get the most desirable schools.

Step 1. Utilize IVIFHWG operator (Let $\omega=(0.3,0.1,0.2,0.4)$), we derive the overall interval-valued intuitionistic fuzzy value $\tilde{r}_i$ of the schools A_i.

$\tilde{r}_1=([0.342,0.542],[0.225,0.388])$

$\tilde{r}_2=([0.474,0.683],[0.158,0.274])$

$\tilde{r}_3=([0.240,0.474],[0.266,0.448])$

$\tilde{r}_4=([0.347,0.626],[0.155,0.286])$

$\tilde{r}_5=([0.434,0.576],[0.169,0.353])$

Step 2. Calculate the scores $S\left(\tilde{r}_i\right)\left(i=1,2,3,4,5\right)$, we get the overall interval-valued intuitionistic fuzzy value $\tilde{r}_i$ of the schools A_i.

$S\left(\tilde{r}_1\right)=0.136, S\left(\tilde{r}_2\right)=0.363, S\left(\tilde{r}_3\right)=0.000$

$S\left(\tilde{r}_4\right)=0.266, S\left(\tilde{r}_5\right)=0.244$

Step 3. Rank all the schools $A_i\left(i=1,2,\cdots,5\right)$ in accordance with the $S\left(\tilde{r}_i\right)\ \left(i=1,2,\cdots,5\right)$: $A_2\succ A_4\succ A_5\succ A_1\succ A_3$, and thus the most desirable school is A_2.

CONCLUSION

In this paper, we investigate the multiple attribute decision making problems for evaluating the physical education teaching and sports training with interval-valued intuitionistic fuzzy information. Some operational laws of interval-valued intuitionistic fuzzy numbers, score functions and accuracy function of interval-valued intuitionistic fuzzy numbers are introduced. Based on these operational laws, we used interval-valued intuitionistic fuzzy Hamacher weighted geometric (IVIFHWG) operator to evaluate the physical education teaching and sports training. Finally, an illustrative example is given to verify the developed approach.

ACKNOWLEDGMENT

The work was supported by the National college students innovation training under Grant No. 201310290064.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this article.

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