ISSN : 0974 - 7435

Volume 10 Issue 24

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(24), 2014 [15833-15839]

The correlation coefficient model for evaluating the university physical education teaching technique with dual hesitant fuzzy information

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ABSTRACT

In this paper, we investigate the problems for evaluating the physical education teaching technique in universities with dual hesitant fuzzy information. Then, we compute the correlation coefficient between each alternative and positive ideal alternative, and then rank the alternatives by means of the correlation coefficient between each alternative and positive ideal alternative. Finally, we shall present a numerical example for evaluating the physical education teaching technique in universities with dual hesitant fuzzy information in order to illustrate the method proposed in this paper.

KEYWORDS

Correlation coefficient; Dual hesitant fuzzy information; Physical education teaching technique.

INTRODUCTION

The 21st century is the century of information. Tremendous progress of information technology in the science of human achievements made one of the most historic, human civilization will increasingly be created by information technology and development[1]. The continuous development of information technology and wide application of modern education will present the characteristics and trends: Since the 90s of the 20th century, the education sector appears to the wide application of information technology is characterized by the development trend of domestic scholars called educational information. In recent years, this trend is the rapid development in China, the impact was so great that many educators feel confused and at a loss[2-3]. Colleges should follow the direction of development of information technology, the initiative to meet the challenges of information technology. PE Applied Teaching and Training Department also appears insufficient. Sport as a rather special subject, the special nature of their teaching is also strong, so information technology in college teaching and training Physical Education Department should also highlight its specificity. Department of Information Technology in Physical Education Teaching and Training of a profound positive impact, however, we also found that the current information technology in college teaching and training Physical Education Department also produced a lot of confusion and misunderstanding, many issues have not caused people's attention, which has been in varying degrees, to avoid or delay of information technology in the application of Physical Education to enhance the depth and level[4].

Since 1999, higher education in China has been expanded to meet the demands of the development of the socialist marketing economy, the popularization of higher education, the improvement of people's living standards and the stability and development of universities and colleges themselves, which enabled the higher education in China to achieve unprecedented success in 2002[5-6]. Teaching quality is closely connected with the survival and development of universities and colleges because it determines both the cultivating quality and competitive ability of graduates, and it plays an extremely important role in the future development of universities and colleges. Thus it is no exaggeration to say that it is a matter of life and death to higher education in China. At present, as far as the undergraduate P.E. major is concerned, one of the serious problems of major reform and development lies in the conflict between the expansion and the quality improvement, namely, in this era of higher education being popularized, how to ensure and improve the teaching quality has become one of the thorniest problems confronting the teaching reform and development of the undergraduate P.E. major[1,7].

In this paper, we investigate the multiple attribute decision making problems for evaluating the physical education teaching technique in universities with dual hesitant fuzzy information. Then, we compute the correlation coefficient between each alternative and positive ideal alternative, and then rank the alternatives by means of the correlation coefficient between each alternative and positive ideal alternative. Finally, we shall present a numerical example for evaluating the physical education teaching technique in universities with dual hesitant fuzzy information in order to illustrate the method proposed in this paper.

PRELIMINARIES

Definition [8]. Let X be a fixed set, then a dual hesitant fuzzy set (DHFS) on X is described as:

$$D = \left(\left\langle x, h(x), g(x) \right\rangle \middle| x \in X \right) \qquad \textbf{(1)}$$

in which $h(x)$ and $g(x)$ are two sets of some values in $[0,1]$, denoting the possible membership degrees and non-membership degrees of the element $x \in X$ to the set D respectively, with the conditions:

$0 \le \gamma, \eta \le 1,\ 0 \le \gamma^{+}, \eta^{+} \le 1$.

Let $X=\{x_1,x_2,\cdots,x_n\}$ be a discrete universe of discourse, $\tilde{A}$ and $\tilde{B}$ be two DHFSs on X denoted as $\tilde{A}=\left(\left\langle x_i,h_A(x_i),g_A(x_i)\right\rangle \middle| x_i\in X,i=1,2,\cdots,n\right)$ and $\tilde{B}=\left(\left\langle x_i,h_B(x_i),g_B(x_i)\right\rangle \middle| x_i\in X,i=1,2,\cdots,n\right)$ respectively[8-9].

The values of DHFEs are usually given in a disorder, and for convenience, we rearrange them in a decreasing order. For a DHFE $\tilde{A}=\left(\left\langle x_i,d(x_i)\right\rangle \middle| x_i\in X,i=1,2,\cdots,n\right)$ $=\left(\left\langle x_i,h_A(x_i),g_A(x_i)\right\rangle \middle| x_i\in X,i=1,2,\cdots,n\right)$, let $\sigma:(1,2,\cdots,n)\to(1,2,\cdots,n)$ be a permutation which satisfying $h_A\left(x_{\sigma(i)}\right)\ge h_A\left(x_{\sigma(i+1)}\right), i=1,2,\cdots,n-1$, $g_A\left(x_{\sigma(i)}\right)\ge g_A\left(x_{\sigma(i+1)}\right), i=1,2,\cdots,n-1$, and $h_A\left(x_{\sigma(i)}\right)$ be the ith largest value in $h_A(x_i)$, $g_A\left(x_{\sigma(i)}\right)$ be the ith largest value in $g_A(x_i)$.

Let $l_{d(x_i)}=\left\{l\left(h_A(x_i)\right),l\left(g_A(x_i)\right)\right\}$ for each x_i in X, where $l\left(h_A(x_i)\right)$ and $l\left(g_A(x_i)\right)$ represent the number of values in $h_A(x_i)$ and $g_A(x_i)$, respectively. For two DHFSs $\tilde{A}$ and $\tilde{B}$, When $l\left(h_A(x_i)\right)\ne l\left(h_B(x_i)\right)$, $l\left(g_A(x_i)\right)\ne l\left(g_B(x_i)\right)$, one can make them having the same number of elements through adding some elements to the DHFE which has less number of elements. In terms of the pessimistic principle, the smallest element will be added while in the opposite case, the optimistic principle may be adopted. In the present work, we use the former case. Especially, if $l\left(h_A(x_i)\right)<l\left(h_B(x_i)\right)$, then $h_B(x_i)$ should be extended by adding the minimum value in it until it has the same length as $h_A(x_i)$; if $l\left(g_A(x_i)\right)<l\left(g_B(x_i)\right)$, then $g_B(x_i)$ should be extended by adding the maximum value in it until it has the same length as $g_A(x_i)$.

In the following, we introduced the informational energy for DHFSs and the corresponding correlation.

Definition 2[10]. For a DHFS $\tilde{A}=\left(\left\langle x_i,h_A(x_i),g_A(x_i)\right\rangle \middle| x_i\in X,i=1,2,\cdots,n\right)$, the information energy of the set $\tilde{A}$ is defined as:

$$E_{DHFS}\left(\tilde{A}\right)=\sum_{i=1}^{n}\left(\frac{1}{l_{h_A(x_i)}}\sum_{j=1}^{l_{h_A(x_i)}}\left(h_{A_{\sigma(j)}}(x_i)\right)^2+\frac{1}{l_{g_A(x_i)}}\sum_{j=1}^{l_{g_A(x_i)}}\left(g_{A_{\sigma(j)}}(x_i)\right)^2\right) \tag{2}$$

Definition 3. For two DHFSs $\tilde{A}$ and $\tilde{B}$, their correlation is defined by

$$C_{DHFS_1}\left(\tilde{A},\tilde{B}\right)=\sum_{i=1}^{n}\left(\frac{1}{l_{h(x_i)}}\sum_{j=1}^{l_{h(x_i)}}\left(h_{A_{\sigma(j)}}(x_i)h_{B_{\sigma(j)}}(x_i)\right)+\frac{1}{l_{g(x_i)}}\sum_{j=1}^{l_{g(x_i)}}\left(g_{A_{\sigma(j)}}(x_i)g_{B_{\sigma(j)}}(x_i)\right)\right) \tag{3}$$

Using the definition (14) and (15), we derive a correlation coefficient for two DHFSs:

Definition 4[10]. The correlation coefficient between two DHFSs $\tilde{A}$ and $\tilde{B}$ is given as:

$$\rho_{DHFS_1}\left(\tilde{A},\tilde{B}\right)=\frac{C_{DHFS_1}\left(\tilde{A},\tilde{B}\right)}{\sqrt{\left[C_{DHFS_1}\left(\tilde{A},\tilde{A}\right)\right]}\sqrt{\left[C_{DHFS_1}\left(\tilde{B},\tilde{B}\right)\right]}} \tag{4}$$

In practical applications, the elements $x_i\left(i=1,2,\cdots,n\right)$ in the universe X have different weights. Let $w=\left(w_1,w_2,\cdots,w_n\right)^T$ be the weight vector of $x_i\left(i=1,2,\cdots,n\right)$ with $w_i\ge 0, i=1,2,\cdots,n$ and $\sum_{i=1}^{n}w_i=1$, we further extend the correlation coefficient formulas given in Eqs. (14) and (15) as:

Definition 5[10]. The correlation coefficient between two DHFSs $\tilde{A}$ and $\tilde{B}$ is given as:

$$\rho_{DHFS_2}\left(\tilde{A},\tilde{B}\right)=\frac{C_{DHFS_1}\left(\tilde{A},\tilde{B}\right)}{\sqrt{\left[C_{DHFS_1}\left(\tilde{A},\tilde{A}\right)\right]}\sqrt{\left[C_{DHFS_1}\left(\tilde{B},\tilde{B}\right)\right]}}$$

$$=\frac{\sum_{i=1}^{n}w_i\left(\frac{1}{l_{h(x_i)}}\sum_{j=1}^{l_{h(x_i)}}\left(h_{A_{\sigma(j)}}(x_i)h_{B_{\sigma(j)}}(x_i)\right)+\frac{1}{l_{g(x_i)}}\sum_{j=1}^{l_{g(x_i)}}\left(g_{A_{\sigma(j)}}(x_i)g_{B_{\sigma(j)}}(x_i)\right)\right)}{\sqrt{\sum_{i=1}^{n}w_i\left(\frac{1}{l_{h_A(x_i)}}\sum_{j=1}^{l_{h_A(x_i)}}\left(h_{A_{\sigma(j)}}(x_i)\right)^2+\frac{1}{l_{g_A(x_i)}}\sum_{j=1}^{l_{g_A(x_i)}}\left(g_{A_{\sigma(j)}}(x_i)\right)^2\right)}\sqrt{\sum_{i=1}^{n}w_i\sum_{i=1}^{n}\left(\frac{1}{l_{h_B(x_i)}}\sum_{j=1}^{l_{h_B(x_i)}}\left(h_{B_{\sigma(j)}}(x_i)\right)^2+\frac{1}{l_{g_B(x_i)}}\sum_{j=1}^{l_{g_B(x_i)}}\left(g_{B_{\sigma(j)}}(x_i)\right)^2\right)}} \quad \textbf{(5)}$$

THE CORRELATION COEFFICIENT MODEL FOR EVALUATING THE UNIVERSITY PHYSICAL EDUCATION TEACHING TECHNIQUE WITH DUAL HESITANT FUZZY INFORMATION

The following assumptions or notations are used to represent the problems for evaluating physical education teaching technique in universities and colleges with dual hesitant fuzzy 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. If the decision makers provide several interval-valued values for the alternative A_i under the attribute G_j with anonymity, these values can be considered as a dual hesitant fuzzy element d_{ij}. In the case where two decision makers provide the same value, then the value emerges only once in d_{ij}. Suppose that the decision matrix $H=\left(d_{ij}\right)_{m\times n}=\left(h_{ij},g_{ij}\right)_{m\times n}$ is the dual hesitant fuzzy decision matrix, where $d_{ij}\left(i=1,2,\cdots,m,\ j=1,2,\cdots,n\right)$ are in the form of DHFEs.

In the following, we apply the correlation coefficient model for evaluating the physical education teaching technique with dual hesitant fuzzy information.

Step 1. Let $H=\left(d_{ij}\right)_{m\times n}$ be an dual hesitant fuzzy decision matrix, where $\tilde{h}_{ij}=\left(h_{ij},g_{ij}\right)$, which is an attribute value, given by an expert, for the alternative $A_i\in A$ with respect to the attribute $G_j\in G$, $d_i=\left(d_{i1},d_{i2},\cdots,d_{in}\right)$ be the vector of attribute values corresponding to the alternative A_i, $i=1,2,\cdots,m$, $d^+=\left(d_1^+,d_2^+,\cdots,d_n^+\right)$ be the positive ideal alternative.

Step 2. Calculate the correlation efficient between an alternative $A_i\left(i=1,2,\cdots,m\right)$ and the negative ideal alternative A^* as follows

$$\rho_{DHFS_2}\left(\tilde{A}_i,\tilde{A}^*\right)=\frac{C_{DHFS_1}\left(\tilde{A}_i,\tilde{A}^*\right)}{\sqrt{\left[C_{DHFS_1}\left(\tilde{A}_i,\tilde{A}_i\right)\right]}\sqrt{\left[C_{DHFS_1}\left(\tilde{A}^*,\tilde{A}^*\right)\right]}}$$

$$=\frac{\sum_{j=1}^{n}w_j\left(\frac{1}{l_{h_{\sigma(j)}}}\sum_{k=1}^{l_{h_{\sigma(j)}}}\left(h_{\sigma(ij)}h^+_{\sigma(j)}\right)+\frac{1}{l_{g_{\sigma(j)}}}\sum_{k=1}^{l_{g_{\sigma(j)}}}\left(g_{\sigma(ij)}g^+_{\sigma(j)}\right)\right)}{\sqrt{\sum_{j=1}^{n}w_j\left(\frac{1}{l_{h_{\sigma(j)}}}\sum_{k=1}^{l_{h_{\sigma(j)}}}\left(\left(h_{\sigma(ij)}\right)^2\right)+\frac{1}{l_{g_{\sigma(j)}}}\sum_{k=1}^{l_{g_{\sigma(j)}}}\left(\left(g_{\sigma(ij)}\right)^2\right)\right)}\sqrt{\sum_{j=1}^{n}w_j\left(\frac{1}{l_{h_{\sigma(j)}}}\sum_{k=1}^{l_{h_{\sigma(j)}}}\left(\left(h^+_{\sigma(j)}\right)^2\right)+\frac{1}{l_{g_{\sigma(j)}}}\sum_{k=1}^{l_{g_{\sigma(j)}}}\left(\left(g^+_{\sigma(j)}\right)^2\right)\right)}}$$

Step 3. Rank all the alternatives $A_i\left(i=1,2,\cdots,m\right)$ and select the best one (s) in accordance with $\rho_{DHFS_3}\left(\tilde{A},\tilde{A}^*\right)\left(or\ \rho_{DHFS_4}\left(\tilde{A},\tilde{A}^*\right)\right)\left(i=1,2,\cdots,m\right)$. The larger $\rho_{DHFS_3}\left(\tilde{A},\tilde{A}^*\right)\left(or\ \rho_{DHFS_4}\left(\tilde{A},\tilde{A}^*\right)\right)$, the better the alternative A_i will be.

Step 4. End.

NUMERICAL EXAMPLE

21st century will be the informationization centuries. The great progress of information technology will be one of humanity historical significance achievements in the field of science; the human civilization is created and the developed more and more through the information technology. Because the unceasing development and the widespread application of the information technology, the education will present the characteristic and the development trend of modernization. Since 1990s, the trend of application widespread of information technology has appeared in educational circles which are called educational informationization by the domestic scholar. In recent years, this trend make a lot of teaching staffs feel puzzled and lost because it develops so quickly and its influence so great in our country. The university should comply with the development direction of the informationization and greet the informationization challenge initiatively. The teaching of university sports is in weak link of higher education in our country; the application of modern information technology also appears insufficiency in the university sports teaching. The sports as a quite special discipline; its teaching particularity is also strong. So the information technology should also highlight its particularity in the university sports teaching. The information technology has had the profound positive influence in the application of university sports teaching, however simultaneously we also had discovered there were many puzzled and erroneous zone in the application of university sports teaching in current days. Many questions not yet bring people's attention. This has hindered or delayed application depth and the level promotion of the information technology in varying degrees in our country university sports teaching. Suppose a school plans to evaluate class teaching technique in university. There is a panel with five possible higher school teachers $T_i\left(i=1,2,3,4,5\right)$ to select. The school selects four attribute to evaluate the five possible higher school teachers: ①G_1 is the teaching contents; ②G_2 is the teaching method; ③G_3 is the teaching atmosphere; ④G_4 is the teacher quality. In order to avoid influence each other, the decision makers are required to evaluate the five possible higher school teachers $T_i\left(i=1,2,3,4,5\right)$ under the above four attributes in anonymity and the decision matrix $\tilde{D}=\left(d_{ij}\right)_{5\times4}$ is presented in TABLE 1, where $d_{ij}\left(i=1,2,3,4,5,\ j=1,2,3,4\right)$ are in the form of DHFEs.

TABLE 1: Dual hesitant fuzzy decision matrix

	G_1	G_2	G_3	G_4
T_1	{{0.2,0.3},{0.5}}	{{0.4,0.5,0.6},{0.2}}	{{0.4,0.6},{0.2}}	{{0.3},{0.5,0.6}}
T_2	{{0.3,0.4},{0.2}}	{{0.4},{0.2,0.3,0.4}}	{{0.6},{0.3})}	{{0.6,0.8},{0.4}}
T_3	{{0.3,0.5},{0.4}}	{{0.4},{0.3,0.4}}	{{0.5,0.6},{0.3}}	{{0.3,0.5},{0.6}}
T_4	{{0.6,0.7},{0.3)}	{{0.3,0.5},{0.2}}	{{0.2,0.5},{0.3}}	{{0.6,0.7},{0.3)}
T_5	{{0.2},{0.4,0.5}}	{{0.4),{0.3,0.4)}	{{0.8},{0.2}}	{{0.3,0.6},{0.3,0.4}}

In the following, we apply the correlation coefficient model for evaluating the physical education teaching technique with dual hesitant fuzzy information.

Step 1. Determine the most desirable higher school teacher B

$$d^+=\left(\left(0.7,0.2\right),\left(0.6,0.2\right),\left(0.8,0.2\right),\left(0.7,0.3\right)\right)$$

Step 2. Utilize the weight vector $w=(0.3,0.1,0.4,0.2)$, we calculate the correlation efficient $\rho_{DHFS_2}\left(\tilde{A}_i, B\right)(i=1,2,3,4,5)$ between a higher school teachers $A_i\,(i=1,2,3,4,5)$ and the most desirable higher school teacher B.

$$\rho_{DHFS_3}\left(\tilde{A}_1, B\right)=0.8022, \rho_{DHFS_3}\left(\tilde{A}_2, B\right)=0.9131$$
$$\rho_{DHFS_3}\left(\tilde{A}_3, B\right)=0.8611, \rho_{DHFS_3}\left(\tilde{A}_4, B\right)=0.7611$$
$$\rho_{DHFS_3}\left(\tilde{A}_5, B\right)=0.8362$$

Step 3. Rank all the higher school teachers $T_i\,(i=1,2,3,4,5)$ in accordance with the overall correlation efficient $\rho_{DHFS_k}\left(\tilde{A}_i, B\right)(i=1,2,3,4,5): T_2 \succ T_5 \succ T_3 \succ T_4 \succ T_1$. Thus the most desirable higher school teacher is T_2.

CONCLUSION

In this paper, we investigate the problems for evaluating the physical education teaching technique in universities and colleges with dual hesitant fuzzy information. We utilize the uncertain linguistic weighted averaging (ULWA) operator to aggregate the uncertain linguistic information corresponding to each alternative and get the overall value of the alternatives, then rank the alternatives and select the most desirable one (s) by using the formula of the degree of possibility for the comparison between two uncertain linguistic variables. Finally, a practical example for evaluating the physical education teaching technique in universities and colleges with dual hesitant fuzzy information is used to illustrate the developed procedures. In the future, we shall continue working in the application of the trapezoidal intuitionistic fuzzy multiple attribute decision-making to other domains[11-15].

CONFLICT OF INTERESTS

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

REFERENCES

[1] Donggen Zhong; "A Novel Efficient Model for Evaluating the Physical Education Teaching Technique in Universities and Colleges", Journal of Convergence Information Technology, **8(9)**, 648-653 **(2013)**.

[2] Shirong Li; "Model for Evaluating the Physical Education Teaching Technique with Uncertain Linguistic Information", International Journal of Digital Content Technology and its Applications, **6(22)**, 767- 74, **(2012)**.

[3] Fazhi Sun; "Comprehensive Evaluation and Research on Teaching Abilities of Basketball to the Normal Colleges Students Specializing in Basketball of Physical Education", International Journal of Digital Content Technology and its Applications, **7(2)**, 379-385 **(2013)**.

[4] Zongxiang Liu; "A Comprehensive Evaluation Method for Physical Education Teaching Based on Analytic Hierarchy Process", International Journal of Digital Content Technology and its Applications, **7(2)**, 404-411 **(2013)**.

[5] Yuzhong Le; "Integration Pattern Research of Information Technology in Physical Education", International Journal of Digital Content Technology and its Applications, **7(3)**, 248-256 **(2013)**.

[6] Sun Ling-ling, Luo Qiang; "Research on Dynamic Coupling model of Physical Education Based on the psychological Center Theory", International Journal on Advances in Information Sciences and Service Sciences, **5(6)**, 725-732 **(2013)**.

[7] Fu Ming, Zhang Qiaosheng; "The Fuzzy Comprehensive Evaluation Research of College Students' Physical Education Teaching Effect", International Journal on Advances in Information Sciences and Service Sciences, **5(7)**, 825-833 **(2013)**.

[8] Bin Zhu, Zeshui Xu, Meimei Xia; Dual hesitant fuzzy sets, Journal of Applied Mathematics, Article ID 879629, http://www.hindawi. com/ journals/ jam/2012 /879629/, **2012**, 13 **(2012)**.

[9] Hongjun Wang, Xiaofei Zhao, Guiwu Wei; Dual Hesitant Fuzzy Aggregation Operators in Multiple Attribute Decision Making, Journal of Intelligent and Fuzzy Systems, **26(5)**, 2281–2290 **(2014)**.

[10] Yuanfang Chen, Xiaodong Peng, Guohua Guan, Huade Jiang; Approaches to multiple attribute decision making based on the correlation coefficient with dual hesitant fuzzy information, **26(5)**, 2547-2556 **(2014)**.

[11] Zeshui Xu; "Induced uncertain linguistic OWA operators applied to group decision making, Information fusion, **7(2)**, 231-238 **(2006)**.

[12] S.Choi, I.H.Youn, R.LeMay, S.Burns, J.H.Youn; "Biometric gait recognition based on wireless acceleration sensor using k-nearest neighbor classification," in Proceedings of the International Conference on Computing, Networking and Communications, 1091–1095 **(2014)**.

[13] Y.Sui, X.Zou, E.Y.Du, F.Li; "Design and analysis of a highly user-friendly, secure, privacy-preserving, and revocable authentication method," IEEE Transactions on Computers, **63(4)**, 902–916 **(2014)**.

[14] J.Mun; "Security controls based on K-ISMS in cloud computing service," in Advanced in Computer Science and Its Applications, **297**, 391–404 Springer **(2014)**.

[15] X.Xu; "Global and initiative safety mechanism in industrial control system," International Journal of Computational Science and Engineering, **9(1-2)**, 139–146 **(2014)**.