ISSN : 0974 - 7435 Volume 10 Issue 16

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(16), 2014 [9354-9359]

Model for selecting the teaching model under the mode of MOOC

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ABSTRACT

In this paper, we investigate the multiple attribute group decision making problems for selecting the teaching model under the mode of MOOC with linguistic information. We utilize the linguistic weighted geometric (LWG) operator and linguistic hybrid geometric (LHG) operator to aggregate the linguistic information corresponding to each mode of MOOC and get the overall value, then rank all the modes of MOOC and select the most desirable one (s) by using the overall value of the mode of MOOC. Finally, an illustrative example for selecting the teaching model under the mode of MOOC is given to verify the developed approach and to demonstrate its practicality and effectiveness.

KEYWORDS

Multiple attribute group decision-making; Linguistic information; Linguistic hybrid geometric (LHG) operator; Teaching model; Mode of MOOC.

INTRODUCTION

Over the last decades there has been a general movement in language teaching away from studying about language towards a focus on teaching the language as a real tool to communicate. As a direct consequence of this trend, content-based instruction (CBI) has become increasingly popular as a means of developing linguistic ability in a great variety of educational contexts. CBI is a method of teaching second/foreign languages that integrates language instruction with instruction in the content areas. CBI is accepted as one of the most representative contributions to contemporary second/foreign language pedagogy. CBI possesses a solid theoretical foundation. In the first instance, general educational theories, including experiential learning theory and constructivism, provide support to CBI. Secondly, according to the functional view of language, language is a vehicle for the expression of functional meaning; learning a language is not only learning its "usage", but also its "use" in real situations. Finally, theories of second language acquisition indicate that natural language acquisition occurs in context, and learners can acquire the language by being exposed to a significant amount of input. CBI provides a context in which meaningful communication may occur and lead to efficient language acquisition. Second language acquisition increases with content-based language instruction because learners learn language best when there is an emphasis on relevant and meaningful content rather than on the language itself. The Knowledge Framework, the task-based approach and the Six-T's approach all contribute to learners' language acquisition in CBI. CBI has been widely used in an extensive number of educational settings all over the world in a variety of models. Numerous empirical studies exist to demonstrate the efficacy of CBI in developing the learners' language proficiency, especially in the ESL settings. However, there have been very few reports on empirical studies on teaching model under the mode of MOOC, especially in the Chinese College English context.

The aim of this paper is to investigate the effectiveness of MOOC model to train the teaching skills of "would be" English teachers in Harbin Normal University. A culture course introducing western and Chinese culture will commence by the end of this paper. The course is targeted for the English learners. In order to do so, in this paper, we shall investigate the multiple attribute group decision making problems for selecting the teaching model under the mode of MOOC with linguistic information. Then, we utilize the linguistic weighted geometric operator and linguistic hybrid geometric operator to aggregate the linguistic information corresponding to each mode of MOOC and get the overall value, then rank all the modes of MOOC and select the most desirable one (s) by using the overall value of the mode of MOOC. Finally, an illustrative example for selecting the teaching model under the mode of MOOC is given to verify the developed approach and to demonstrate its practicality and effectiveness.

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[8-9]:①The set is ordered: $s_i > s_j$, if $i > j$;②There is the negation operator: $neg(s_i) = s_j$ such that $j = t + 1 - i$;③Max operator: $\max(s_i, s_j) = s_i$, if $s_i \geq s_j$;④Min operator: $\min(s_i, s_j) = s_i$, if $s_i \leq s_j$. For example, S can be defined as

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

To preserve all the given information, the discrete term set S should be extended to a continuous term set $\bar{S} = \{s_a \,|\, s_1 \leq s_a \leq s_q, a \in [1, q]\}$, where q is a sufficiently large positive integer. If $s_a \in S$, then s_a is termed an original linguistic term, otherwise, s_a is termed a virtual linguistic term. For example, all the linguistic terms in S are original linguistic terms, the other linguistic terms which don't belong to S, such as $s_{4.5}$ and $s_{6.5}$ are virtual linguistic terms, here $s_{4.5}$ denotes a linguistic term located between "medium" and "good", and $s_{6.5}$ denotes a linguistic term located between "very good" and "extremely good". In general, the decision maker uses the original linguistic term to evaluate attributes and alternatives, and the virtual linguistic terms can only appear in calculation[8-9].

Definition 1[10]. A linguistic ordered weighted geometric (LWG) operator of dimension n is a mapping LWG: $\bar{S}_n \to S_n$, which has associated with it an exponential weighting vector $\omega = (\omega_1, \omega_2, \cdots, \omega_n)^T$, with $\omega_j \in [0,1]$ and $\sum_{j=1}^{n} \omega_j = 1$, such that:

$$\mathrm{LWG}_{\omega}\left(s_{\alpha_1}, s_{\alpha_2}, \cdots, s_{\alpha_n}\right) = \left(s_{\alpha_1}\right)^{\omega_1} \otimes \left(s_{\alpha_2}\right)^{\omega_2} \otimes \cdots \otimes \left(s_{\alpha_n}\right)^{\omega_n} \quad \textbf{(1)}$$

Definition 2[10]. A linguistic ordered weighted geometric (LOWG) operator of dimension n is a mapping LOWG: $\overline{S}_n \to S_n$, which has associated with it an exponential weighting vector $w = \left(w_1, w_2, \cdots, w_n\right)^T$, with $w_j \in [0,1]$ and $\sum_{j=1}^{n} w_j = 1$, such that:

$$\mathrm{LOWG}_{w}\left(s_{\alpha_1}, s_{\alpha_2}, \cdots, s_{\alpha_n}\right) = \left(s_{\beta_1}\right)^{w_1} \otimes \left(s_{\beta 2}\right)^{w_2} \otimes \cdots \otimes \left(s_{\beta n}\right)^{w_n} \quad \textbf{(2)}$$

Definition 3[11]. Let $s_i \left(i = 1, 2, \cdots, n\right)$ be a linguistic terms sets, and

$$\mathrm{LHG}_{w,\omega}\left(s_1, s_2, \cdots, s_n\right) = \left(r_1\right)^{w_1} \otimes \left(r_2\right)^{w_2} \otimes \cdots \otimes \left(r_n\right)^{w_n} = \overset{n}{\underset{i=1}{\otimes}} \left(r_i\right)^{w_i} \quad \textbf{(3)}$$

where $w = \left(w_1, w_2, \cdots, w_n\right)$ is the associated weighting vector, with $w_j \in [0,1]$, $\sum_{j=1}^{n} w_j = 1$, and r_i is the i-th largest element of the linguistic weighted argument $r_i'\left(r_i' = \left(s_i\right)^{n\omega_i}\right)$, $\omega = \left(\omega_1, \omega_2, \cdots, \omega_n\right)$ is the weighting vector of linguistic variables $s_i \left(i = 1, 2, \cdots, n\right)$, with $\omega_i \in [0,1]$, $\sum_{i=1}^{n} \omega_i = 1$, and n is the balancing coefficient, then the function LHG is called the linguistic hybrid geometric (LHG) operator of dimension n.

MODEL FOR SELECTING THE TEACHING MODEL UNDER THE MODE OF MOOC

In this section, we consider a multiple attribute group decision making problems for selecting the teaching model under the mode of MOOC with linguistic information. Let $A = \left\{A_1, A_2, \cdots, A_m\right\}$ be a discrete set of alternatives, and $G = \left\{G_1, G_2, \cdots, G_n\right\}$ be the set of attributes, $\omega = \left(\omega_1, \omega_2, \cdots, \omega_n\right)$ is the weighting vector of the attributes $G_j \left(j = 1, 2, \cdots, n\right)$, where $\omega_j \in [0,1], \sum_{j=1}^{n} \omega_j = 1$. Let $D = \left\{D_1, D_2, \cdots, D_t\right\}$ be the set of decision makers, and $\nu = \left(\nu_1, \nu_2, \cdots, \nu_t\right)$ be the weight vector of decision makers, where $\nu_k \in [0,1], \sum_{k=1}^{t} \nu_k = 1$. Suppose that $R_k = \left(r_{ij}^{(k)}\right)_{m \times n}$ is the decision matrix, where $r_{ij}^{(k)} \in S$ 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 $G_j \in G$.

In the following, we apply the LWG and LHG operators to MAGDM for selecting the teaching model under the mode of MOOC with linguistic information.

Step 1. Utilize the decision information given in matrix R_k, and the LWG operator

$$r_i^{(k)} = \mathrm{LWG}_{\omega}\left(r_{i1}^{(k)}, r_{i2}^{(k)}, \cdots, r_{in}^{(k)}\right), i = 1, 2, \cdots, m, k = 1, 2, \cdots, t. \quad \textbf{(4)}$$

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

Step 2. Utilize the LHG operator:

$$r_i = \mathrm{LHG}_{\nu,w}\left(r_i^{(1)}, r_i^{(2)}, \cdots, r_i^{(t)}\right), i = 1, 2, \cdots, m \quad \textbf{(5)}$$

to derive the collective overall preference values $\tilde{r}_i\left(i=1,2,\cdots,m\right)$ of the alternative A_i, where $v=\left(v_1,v_2,\cdots,v_n\right)$ be the weight vector of decision makers, with $v_k\in\left[0,1\right]$, $\sum_{k=1}^{t}v_k=1$, $w=\left(w_1,w_2,\cdots,w_t\right)$ is the associated weighting vector of the LHG operator, with $w_k\in\left[0,1\right]$, $\sum_{k=1}^{t}w_k=1$.

Step 3. Rank all the alternatives $A_i\left(i=1,2,\cdots,m\right)$ and select the best one (s) in accordance with $r_i\left(i=1,2,\cdots,m\right)$.

Step 4. End.

NUMERICAL EXAMPLE

In this section, we investigate the multiple attribute group decision making problems for selecting the teaching model under the mode of MOOC with linguistic information. In this section, we present an empirical case study for selecting the teaching model under the mode of MOOC with linguistic information. There is a panel with five possible teaching modes of MOOC $S_i\left(i=1,2,3,4,5\right)$ to select. The experts select four attribute to evaluate the five possible teaching modes of MOOC: G_1 is the environment of teaching and studying; G_2 is the management of teaching information; G_3 is the curriculum design and target; G_4 is the empathy and the teaching practice. The five possible teaching modes of MOOC $A_i\left(i=1,2,3,4\right)$ are to be evaluated using the linguistic term set S by the three decision makers $D_k\left(k=1,2,3\right)$ (whose weighting vector $v=\left(0.50,0.20,0.30\right)$) under the above four attributes (whose weighting vector $\omega=\left(0.30,0.10,0.20,0.40\right)^T$), and construct, respectively, the decision matrices as follows $R_k=\left(r_{ij}^{(k)}\right)_{5\times4}\left(k=1,2,3,4\right)$:

$$R_1=\begin{array}{c} \\ A_1\\ A_2\\ A_3\\ A_4\\ A_5\end{array}\begin{array}{c}\begin{array}{cccc}G_1 & G_2 & G_3 & G_4\end{array}\\ \begin{pmatrix} s_4 & s_2 & s_4 & s_5\\ s_6 & s_4 & s_3 & s_2\\ s_6 & s_5 & s_7 & s_6\\ s_3 & s_6 & s_6 & s_7\\ s_5 & s_4 & s_5 & s_4\end{pmatrix}\end{array}$$

$$R_2=\begin{array}{c} \\ A_1\\ A_2\\ A_3\\ A_4\\ A_5\end{array}\begin{array}{c}\begin{array}{cccc}G_1 & G_2 & G_3 & G_4\end{array}\\ \begin{pmatrix} s_4 & s_2 & s_6 & s_4\\ s_4 & s_6 & s_3 & s_6\\ s_6 & s_6 & s_7 & s_2\\ s_4 & s_6 & s_6 & s_4\\ s_5 & s_4 & s_5 & s_1\end{pmatrix}\end{array}$$

$$R_3=\begin{array}{c} \\ A_1\\ A_2\\ A_3\\ A_4\\ A_5\end{array}\begin{array}{c}\begin{array}{cccc}G_1 & G_2 & G_3 & G_4\end{array}\\ \begin{pmatrix} s_5 & s_5 & s_3 & s_5\\ s_5 & s_7 & s_4 & s_3\\ s_1 & s_4 & s_7 & s_6\\ s_4 & s_5 & s_6 & s_5\\ s_3 & s_4 & s_5 & s_2\end{pmatrix}\end{array}$$

In the following, we apply the LWG and LHG operators to MAGDM for selecting the teaching model under the mode of MOOC with linguistic information. To get the most desirable selecting the teaching model under the mode of MOOC, the following steps are involved:

Step 1. Utilize the decision information given in matrix $\tilde{R}_k$, and the LWG operator $\left(let\ \omega = \left(0.30, 0.10, 0.20, 0.40\right)^T\right)$:

$$r_i^{(k)} = \mathrm{LWG}_{\omega}\left(r_{i1}^{(k)}, r_{i2}^{(k)}, \cdots, r_{in}^{(k)}\right), i = 1,2,3,4,5, k = 1,2,3$$

to derive the individual overall preference value $r_i^{(k)}$ of the teaching modes of MOOC A_i.

$$r_1^{(1)} = s_{4.08}, r_2^{(1)} = s_{3.23}, r_3^{(1)} = s_{6.08}, r_4^{(1)} = s_{5.18}, r_5^{(1)} = s_{4.47}$$

$$r_1^{(2)} = s_{4.05}, r_2^{(2)} = s_{4.63}, r_3^{(2)} = s_{3.99}, r_4^{(2)} = s_{4.52}, r_5^{(2)} = s_{2.57}$$

$$r_1^{(3)} = s_{4.51}, r_2^{(3)} = s_{4.03}, r_3^{(3)} = s_{3.47}, r_4^{(3)} = s_{4.85}, r_5^{(3)} = s_{2.91}$$

Step 2. Utilize the LHG operator:

$$r_i = \mathrm{LHG}_{v,w}\left(r_i^{(1)}, r_i^{(2)}, r_i^{(3)}\right), i = 1,2,3,4$$

to derive the collective overall preference values $r_i\left(i = 1,2,3,4\right)$ of the teaching modes of MOOC A_i, where $v = \left(0.50, 0.20, 0.30\right)$ be the weighting vector of decision makers, $w = \left(0.30, 0.50, 0.20\right)$ is the associated weighting vector of the LHG operator.

$$r_1 = s_{39.17}, r_2 = s_{21.09}, r_3 = s_{70.40}, r_4 = s_{88.54}, r_5 = s_{16.16}$$

Step 3. Rank all the teaching modes of MOOC $A_i\left(i = 1,2,3,4,5\right)$ in accordance with the overall preference values $r_i\left(i = 1,2,3,4,5\right)$: $A_4 \succ A_1 \succ A_1 \succ A_2 \succ A_5$. Thus the most desirable teaching mode of MOOC is A_4.

CONCLUSION

In this paper, we investigate the multiple attribute group decision making problems for selecting the teaching model under the mode of MOOC with linguistic information. We utilize the linguistic weighted geometric (LWG) operator and linguistic hybrid geometric (LHG) operator to aggregate the linguistic information corresponding to each mode of MOOC and get the overall value, then rank all the modes of MOOC and select the most desirable one (s) by using the overall value of the mode of MOOC. Finally, an illustrative example for selecting the teaching model under the mode of MOOC is given to verify the developed approach and to demonstrate its practicality and effectiveness.

ACKNOWLEDGMENT

The work was supported by the Heilongjiang Province College Students' Innovative Training Program (201410231050), the title of this project is the College Students' MOOC Lecturer Training Programme-MOOC Western and Chinese Culture Course Development.

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