An Autonomy Teaching Evaluation Technology based on Improved ELECTRE Method / Uma Tecnologia de Avaliação de Ensino de Autonomia baseada no Método ELECTRE Melhorado

abstract

The introduction of network technology in College English teaching undoubtedly breaks through traditional teaching mode, extends teaching space and gives students sufficient practice opportunities. For this reason, an autonomy teaching mode is proposed to the food science based on constructivism theory. Also, a novel evaluation technology to the autonomy teaching mode is constructed based on an improved ELECTRE method. The final experimental results suggest that situational teaching of food English trains students’ communication ability and professional expression ability, and improves students’ comprehensive quality obviously.

resumo

A introdução da tecnologia de rede no ensino universitário de ensino indubitavelmente rompe o modo de ensino tradicional, amplia o espaço de ensino e oferece aos alunos oportunidades de prática suficientes. Por esse motivo, um modo de ensino de autonomia é proposto à ciência alimentar com base na teoria do construtivismo. Além disso, uma nova tecnologia de avaliação para o modo de ensino de autonomia é construída com base em um método ELECTRE melhorado. Os resultados experimentais finais sugerem que o ensino situacional do Inglês alimentar treina a capacidade de comunicação e a capacidade de expressão profissional dos estudantes e melhora a qualidade abrangente dos alunos obviamente.
section i

introduction

The first step of College English teaching reform is to change "teacher-centered teaching mode" to "student-centered teaching mode". The introduction of network technology in College English teaching undoubtedly breaks through traditional teaching mode, extends teaching space and gives students sufficient practice opportunities. New "teaching requirements" indicate advanced information technologies should be used in quantity to develop and construct various courses based on computer and network, and to offer favorable language learning environment and conditions for students. Network presents English knowledge to students in the form of pictures and texts, establishes both-way communicate between teachers and students, makes the distance between students and teaching contents and between teachers and students, accelerates knowledge communication pace, expands and deepens breadth and depth of English knowledge. Besides, it pays special attention to students' participation, practice and thinking in the application process, and guides teachers to gradually change the role so as to really achieve "student-centered" teaching mode.

Swiss psychologist Piaget proposed Constructionism at the earliest and considered, "children gradually construct cognition of the outer world in the process of interacting with surroundings so as to develop their cognitive structure". Constructivism can be utilized to well explain cognitive rules of human learning process. Constructivism holds that "learning is a process of acquiring knowledge, but learners utilize necessary learning materials and acquire knowledge through meaning construction under certain learning situation and with the help of others. Constructivism learning theory believes that situation, cooperation, conversation and meaning construction are four major elements on learning environment. Among these factors, learning situation is in a very important position. Situation in learning environment must contribute to students' meaning construction of the contents learned. In modern teaching, except three links involving teacher, student and teaching material, multiple teaching media such as network should be applied usually. The four links are not combined together purely and independently, but form an organic whole through mutual relevance and interactions. The result of combination is to make students give full play to network advantages and acquire knowledge in proper learning situation. In college English teaching practice based on computer network, network provides teaching with valuable help. Firstly, sound, image and video of computer network can mobilize students' various organs, dig and utilize intuitive thinking. Secondly, extendibility of information media and computer interactivity can enable students to carry out hypertext link, choose, organize and extract information. Students can be evaluated and gain feedbacks. Students take active part in learning process to discover, conclude and master internal rules in language. Such cognition participation greatly mobilizes students' potential and cultivates students' independent study strategy.

section ii

novel autonomy teaching modes

2.1 Constructivism Theory

As psychologists continuously deepen study on cognitive rules of human learning process, constructivism learning theory has gradually become popular in recent years. Constructivism is student-centered and underlines students' active exploration of knowledge, active discovery and active construction of knowledge meaning (rather than sending knowledge from teachers' brain to students' notebook like traditional teaching). Student-centered teaching mode stresses 'learning'; teacher-centered teaching mode emphasizes 'teaching'. This is the fundamental divergence point of the two education thoughts and teaching ideas. Two contrary learning theories, teaching theories and teaching design theories develop. Since learning environment required by constructivism gains strong support of latest information technology, constructivism is increasingly combined with teachers' teaching practice and thus becomes a guiding ideology
of domestic and overseas schools to deepen teaching reform. Constructivism learning theory considers learning should own three basic features.

(1) Learn in the process of problem solving. Constructivism learning theory holds that study is not just knowledge transfer and convey from the outside to the inside, but also a process where learners actively construct their knowledge and experience. In other words, students enrich and transform their knowledge and experience through interactions between new learning activities, original knowledge and experience. Therefore, students should form questions in allusion to subject content, then explore, question, seek answers and solve cognitive conflict. Through such activity, students can construct understanding of knowledge. Case teaching guides students to serve as ‘the party involved’ through creating problem situation, to combine instructional theory and actual teaching problems and to construct their personal experience and internalized knowledge through case analysis and group discussion.

(2) Pay attention to interactions of sociality. Constructivism advocates letting students learn and help each other in group or team study. Students can construct their knowledge structure through equal contact with students, teachers and surroundings. Case teaching exactly offers such an exchange platform. In case teaching, class discussion and other forms of cooperative learning, students construct deeper understanding of knowledge through exchange, dispute and opinion combination.

(3) Construct physical situation of learning, in teaching, teachers do not pre-design information sequence, but design learning situation for students and organize students for exploration. Constructivism proposes to set learning in real and complex situation so as to make learners adapt different problem situations and transfer more extensively in practical life. In case teaching, every real and typical case teaching is physical situation which is closest to practical teaching.

2.2 Situational Teaching Mode

(1) Real Task Setting. Constructivism advocates situational teaching, and teaching content is real task. Learning situation and learning worksheet suitable for teaching are designed according to typical work task. Students need to complete different tasks respectively such as salesperson and administrative staff. To complete the task, students must actively carry out data retrieval, practice and group discussion to master relevant vocational English knowledge and train professional ability and language competence.

(2) Multimedia teaching. In food English teaching, rational application of multimedia in visual demonstration can effectively break through difficulties. Teachers create situations for teaching, and utilize modern education multimedia to dynamically introduce animation, TV and film in teaching process so as to train students’ verbal communication ability and professional expression ability.

Animation demonstration can break through teaching key and difficult points. Rational application of animation in visual demonstration can effectively break through difficulty points. Sometimes, teachers speak arduously, while students do not understand. If animation is adopted for visual demonstration, the effect will be completely different. For example, when teaching chocolate making process, virtual situational teaching may be adopted in the form of animation, ranging from cocoa bean plantation and harvest to chocolate production. In this way, students seem to be personally on the scene and thus improve their learning interest.

Concept map contributes to boosting teaching and learning effects. To enhance students’ comprehension of knowledge, students are required to express specialized food knowledge with simple language by concept map and literal statement according to their own comprehension in assignments and examinations. Such method to make hard things simple has achieved good effects and eliminates students’ fear of food English. Meanwhile, students greatly enhance their understanding of English knowledge of food specialty. Students are suggested to use Gliffy online drawing tool to express chocolate making process in the form of concept map.

Situation learning can easily simulate students’ learning motivation and enhance students’ autonomous learning ability. Animation and other virtual situational teaching methods cultivate students’ interest in learning food English. The completion of concept map and flow chart also makes students enjoy sense of achievement brought by learning.

2.3 Scaffolding Teaching Mode

Constructivism considers that scaffolding teaching provides conceptual framework for learners, makes complex learning tasks simplified and guides learners’ comprehension. Such teaching mode distinctly reflects ‘combination of learning and work’ of vocational courses. For example, during teaching the topic of chocolate, the following steps may be followed.

(1) Scaffold setup: we have found during survey of students that students generally lack food terminology. Thus in preparation stage before class, the author provided knowledge scaffold of basic language knowledge and food English (chocolate making) for students.
(2) Situation creation: American experts visit chocolate factory, and students are responsible for designing the leaflet of chocolate factory.

(3) Task setting: group and survey chocolate history, chocolate making, chocolate variety and production equipment.

(4) Exploration practice: students look up materials and pictures according to task requirements and set about editing the leaflet. Teachers give guidance for the problems proposed by students.

(5) Effect evaluation: after the leaflet is finished, groups discuss and evaluate each other. Scaffolding teaching mode reduces teachers’ instruction, shifts teacher-dominated teaching to student-dominated teaching and cultivates students’ independent exploration and independent ability.

section iii

improved electre method

In order to be specific and do not lose the generality, \( C_j \) (j = 1, 2, ⋯, m) are all supposed to be benefit attributes. \( p_j, q_j \) and \( v_j \) signify strictly superior to the threshold value, indifference threshold value and veto threshold value respectively between projects on \( C_j \). For the first kind of threshold value, suppose that \( p_j \) is less than the difference between values of project \( a_j \) and project \( a_k \) on \( C_j \), then we consider that the relation between \( a_j \) and \( a_k \) is the former strictly superior to the latter; for the second kind of threshold value, suppose that \( q_j \) is more than the difference between values of project \( a_j \) and project \( a_k \) on \( C_j \), then it can be considered that there is indifference relation between these two projects; for the last threshold value, suppose that \( v_j \) is less than or equal to the difference between values of project \( a_j \) and project \( a_k \) on \( C_j \) (the value of \( a_k \) is more than \( a_j \)), then we can vote down that the overall level of \( a_j \) is superior to \( a_k \). This shows that \( 0 \leq q_j \leq p_j \leq v_j \).

3.1 Definition of Three Indexes

(1) Concordance Index, which can be expressed as \( c(a_j, a_k) \). This index refers to the supporting degree to thesis that ‘the level of \( a_j \) is higher than \( a_k \)’, which can be defined as

\[
c(a_j, a_k) = \frac{1}{w} \sum_{j=1}^{m} w_j c_j(a_j, a_k)
\]

Where

\[
w = \sum_{j=1}^{m} w_j
\]

\[
c_j(a_j, a_k) = \begin{cases} 
0 & \text{if } y_j(a_j) + p_j \leq y_j(a_k) \\
1 & \text{if } y_j(a_j) + q_j \geq y_j(a_k) \\
\frac{y_j(a_j) + p_j - y_j(a_k)}{p_j - q_j} & \text{other}
\end{cases}
\]

This index refers to the degree that project \( a_j \) is superior to project \( a_k \) on \( C_j \).

(2) Non-concordance Index, which refers to the denying degree to thesis that ‘the level of \( a_j \) is higher than \( a_k \)’, which can be defined as

\[
d_j(a_j, a_k) = \begin{cases} 
0 & \text{if } y_j(a_j) + p_j \geq y_j(a_k) \\
1 & \text{if } y_j(a_j) + v_j \leq y_j(a_k) \\
\frac{y_j(a_k) - y_j(a_j) - p_j}{v_j - p_j} & \text{other}
\end{cases}
\]

(3) Credibility Index, which refers to the credibility of that ‘the level of \( a_j \) is higher than \( a_k \)’, the value of which can be defined as

\[
s_j(a_j, a_k) = \begin{cases} 
c(a_j, a_k) & \text{if } \forall C_j, d_j(a_j, a_k) \leq c(a_j, a_k) \\
c(a_j, a_k) \times \prod_{j} \frac{1 - d_j(a_j, a_k)}{1 - c(a_j, a_k)} & \text{if } \forall C_j, d_j(a_j, a_k) > c(a_j, a_k)
\end{cases}
\]
3.2 Build the Preference Matrix

Every decision maker has his own point of view to judge and different preferences, so that they often use different dimensions and standards to make decisions. After finishing the ranking of alternatives by using ELECTRE-III method, we cannot simply use the average method or Borda method to integrate single decision result as the overall result, which doesn’t conform to actual situations. Therefore, we need to put forward a new method to make the group reflect different dimensions and standards during the sorting process. Here, credibility index and the rating placement of project have greater relation with these dimensions and standards. We need to consider the following two questions at the same time: the relative interval of project while assigning the credibility index as \( s(a_i, a_j) \) and \( s(a_i, a_k) \), the relative rating placement of project on \( s(a_i, a_j) \).

(1) Supposing that \( \Delta Q^s_i (a_i, a_k) \) refers to the relative placement of project on \( (a_i, a_k) \) in the sort. \( Q_i (a_i) \) refers to the order made by person \( l \) for project \( a_i \). If there are \( m \) projects to be ordered, person \( l \) thinks that project \( a_i \) is the best among all the projects, then the \( Q^s_i (a_i) \) is defined as 1. If person \( l \) thinks that project \( a_i \) is the worst one among all projects, then the \( Q^s_i (a_i) \) is defined as \( m \). There are five situations between the relative placement \( \Delta Q^s_i (a_i, a_k) \) in ranking all projects and the project

\[
\Delta Q^s_i (a_i, a_k) = \begin{cases} 
Q_i (a_i) \gg Q_i (a_k) & \text{if } Q_i (a_i) - Q_i (a_k) > \frac{n}{2} \\
Q_i (a_i) > Q_i (a_k) & \text{if } 0 < Q_i (a_i) - Q_i (a_k) \leq \frac{n}{2} \\
Q_i (a_i) = Q_i (a_k) & \text{if } Q_i (a_i) - Q_i (a_k) = 0 \\
Q_i (a_i) < Q_i (a_k) & \text{if } 0 < Q_i (a_k) - Q_i (a_i) \leq \frac{n}{2} \\
Q_i (a_i) << Q_i (a_k) & \text{if } Q_i (a_k) - Q_i (a_i) > \frac{n}{2}
\end{cases}
\]

Where \( Q_i (a_i) \gg Q_i (a_k) \) refers that person \( l \) thinks project \( a_i \) is much better than project \( a_k \). \( Q_i (a_i) > Q_i (a_k) \) refers that person \( l \) thinks project \( a_i \) is a little better than project \( a_k \). \( Q_i (a_i) < Q_i (a_k) \) refers that person \( l \) thinks project \( a_i \) is a little worse than project \( a_k \). \( Q_i (a_i) << Q_i (a_k) \) refers that person \( l \) thinks project \( a_i \) is much worse than project \( a_k \).

When it is necessary to determine the quality sequence of projects, traditional ELECTRE method usually consider that there exists outranking relation while \( s(a_i, a_k) \geq \lambda_{\max} - \beta \) is found, \( \lambda_{\max} = \max s(a_i, a_k) \). \( \beta \) is the intercepting threshold, the value of which is setting by decision makers themselves according to their own experience. Among all these outranking relations, the quality sequence of project \( a_i \) can be determined according to the difference between the number of outflowing directed arc of project \( a_i \) and the number of inflowing directed arc of project \( a_i \). Therefore, there are four situations existed while defining the relative interval of credibility index \( s_i (a_i, a_j) \) and \( s_i (a_i, a_k) \) among each pair-projects

Zone I: \( s_i (a_i, a_k) \geq \lambda_{\max} - \beta, s_i (a_k, a_i) \geq \lambda_{\max} - \beta \)
Zone II: \( s_i (a_i, a_k) \geq \lambda_{\max} - \beta, s_i (a_k, a_i) < \lambda_{\max} - \beta \)
ZoneIII: \( s_i (a_i, a_k) < \lambda_{\max} - \beta, s_i (a_k, a_i) \geq \lambda_{\max} - \beta \)
ZoneIV: \( s_i (a_i, a_k) < \lambda_{\max} - \beta, s_i (a_k, a_i) < \lambda_{\max} - \beta \)

(2) Build the Preference Evaluation Matrix (table 1). Preference Evaluation Matrix is used to measure the quality between project \( a_i \) and project \( a_k \).

Zone I: \( a_iO_i a_k \) refers that project \( a_i \) is much better (\( O_i \)) than project \( a_k \); \( a_iO_k a_k \) refers that project \( a_i \) is little better (\( O_k \)) than project \( a_k \); \( a_iI_a a_k \) refers that there is no difference (\( I \)) between project \( a_i \) and project \( a_k \); \( a_iB_w a_k \) refers that project \( a_i \) is a little worse (\( B_w \)) than project \( a_k \); \( a_iB_s a_k \) refers that project \( a_i \) is much worse (\( B_s \)) than project \( a_k \).

3.3 Consistent Credibility, Non-consistent Credibility and Net Credibility

(1) Consistent credibility \( \Phi^+ (a_i) \) indicates the degree that project \( a_i \) superior to other projects, which can be defined as

\[
\Phi^+ (a_i) = \sum_{a_k \in A} s(a_i, a_k), \forall a_k \in A
\]

(2) Non-consistent credibility \( \Phi^- (a_i) \) is used to show the degree that other projects superior to project \( a_i \), which can be defined as

\[
\Phi^- (a_i) = \sum_{a_k \in A} s(a_k, a_i), \forall a_k \in A
\]

(3) Net credibility \( \Phi (a_i) \) can express the difference between consistent credibility and non-consistent credibility, which can be defined as

\[
\Phi (a_i) = \Phi^+ (a_i) - \Phi^- (a_i)
\]

It can be sorted of the quality for all alternatives according to the value of net credibility \( \Phi (a_i) \). The greater the value of the net credibility \( \Phi (a_i) \) of a project, the better the project is.
3.4 Relation of Group Individuals

(1) Group concordance index \( C_G(a_i, a_k) \) refers to the credibility of supporting thesis that 'project \( a_i \) is better than project \( a_k \)' from the perspective of group, which can be defined as

\[
C_G(a_i, a_k) = \sum_{l=1}^{m} v_l f_l(a_i, a_k)
\]

Where

\[
f_l(a_i, a_k) = \begin{cases} 
1 & \text{if } a_i O a_k \\
0.75 & \text{if } a_i O w a_k \\
0.5 & \text{if } a_i I a_k \\
0.25 & \text{if } a_i B w a_k \\
0 & \text{if } a_i B s a_k
\end{cases}
\]

(2) Group non-concordance index \( D_G(a_i, a_k) \) refers to the credibility of denying thesis 'project \( a_i \) is better than project \( a_k \)' from the perspective of group, which can be defined as

\[
D_G(a_i, a_k) = \sum_{l=1}^{m} v_l g_l(a_i, a_k)
\]

Where

\[
g_l(a_i, a_k) = \begin{cases} 
1 & \text{if } (a_i B s a_k \text{ or } a_i B s a_k) \& (Q_l(a_i) << Q_l(a_j)) \\
0 & \text{other}
\end{cases}
\]

Table 1. Preference Evaluation Matrix

<table>
<thead>
<tr>
<th>( Q_l(a_i) )</th>
<th>Zone I</th>
<th>Zone II</th>
<th>Zone III</th>
<th>Zone IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>( a_i O a_k )</td>
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<td>( a_i B w a_k )</td>
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<tr>
<td>( a_i B s a_k )</td>
<td>( a_i B s a_k )</td>
<td>( a_i B w a_k )</td>
<td>( a_i B s a_k )</td>
<td>( a_i B s a_k )</td>
</tr>
</tbody>
</table>

(3) Group credibility index \( S_G(a_i, a_k) \) refers to the credibility of thesis that 'project \( a_i \) is better than project \( a_k \)', which can be defined as

\[
S_G(a_i, a_k) = C_G(a_i, a_k) \cdot (1 - D_G(a_i, a_k))
\]

3.5 Sort of Group Decision

(1) Group consistency credibility \( \Phi^+_G(a_i) \) refers to estimate the credibility that project \( a_i \) is better than other projects from the perspective of group, which can be defined as

\[
\Phi^+_G(a_i) = \sum_{k=1}^{n} S_G(a_i, a_k)
\]

(2) Group non-consistency credibility \( \Phi^-_G(a_i) \) refers to estimate the credibility that other projects are better than project \( a_i \) from the perspective of group, which can be defined as

\[
\Phi^-_G(a_i) = \sum_{k=1}^{n} S_G(a_k, a_i)
\]

(3) Group net credibility \( \Phi_G(a_i) \) refers to the difference between \( \Phi^+_G(a_i) \) and \( \Phi^-_G(a_i) \), which can be defined as

\[
\Phi_G(a_i) = \Phi^+_G(a_i) - \Phi^-_G(a_i)
\]

It can be sorted for the quality of all alternatives according to the value of \( \Phi_G(a_i) \). In general, the greater the value of the group net credibility of a project, the better the project is.
Microscopically, one-way ANOVA is conducted on the scores of the 8 experimental classes. The result shows that all the items reach a significant level (P<0.05). Initiative study is a modern learning method in contrast with traditional passive learning. Students are taken as the subject and the method realizes the learning targets through their independent analysis, exploration, question and creation. After the experiment, ‘initiative learning ability’ questionnaires on the 8 items of the two classes are made with 20 questions and a full score of 100. The average score of the experimental group is 83.13 and that of the reference group is 74.15. After the T test of two independent samples of questionnaire scores on the ‘initiative learning ability’ of the two classes, it is found that the comparison between the questionnaire scores of ‘initiative learning ability’ experimental class and reference class have statistical meaning(P<0.05).

Observing on the whole, ‘Constructivism’ teaching model is more effective than the ‘traditional’ teaching model in fostering the students’ initiative study and the reasons are: in the ‘traditional’ teaching model, the teaching method is guided wholly by the tutor and the student can only accept positively and their methods is inflexible. While in the ‘Constructivism’ teaching model, the students are subjects and the tutors only act as supporters and guiders in knowledge construction of the students which arouses their learning interests, induce and maintain their study motivations. Through creating context in accordance with the teaching contents and offering the clues between the new and old knowledge, it helps the students construct the meaning of what they are studying. In order to reach the common learning target, the students reinforce their cooperation with their partners consciously. Group members can help each other, learn from each other and explore the student’s initiative learning ability to a great extent, which facilitates the sound development of the student’s personality development. In a bid to gain collective reputation, group members treat each other well, and improve themselves successively in cooperation, which fosters the initiative learning ability and cooperation ability of the students. Macroscopically, ‘one-way ANOVA’ is conducted on the questionnaire results of the 8 experimental classes. The comparison result fails to reach a significant level (P>0.05). All the above data show that there is no obvious difference on ‘initiative learning ability’ of the 8 experimental classes.
section v

conclusions

Constructivism plays a great guiding role in design and teaching of food English teaching. The guiding ideology of vocational college English teaching is to achieve student-oriented English teaching, pay attention to students’ active learning and exploration competence training and highlight situational teaching and group cooperation in learning process. For instance, students search and organize data through computer network, and express research results in the form of text and mind mapping during survey and research. In this process, students train their ability to analyze and solve problems. Group cooperation enhances their exchange, cooperation and communication ability. Students make demonstrations with English in class, which improves their ability to commentate in food English. Situational teaching of food English trains students’ communication ability and professional expression ability, and improves students’ comprehensive quality obviously.

section vi

reference

[2] Xie PN. Reform and Design for College PE and Health Course Content in Our Province. Doctoral Dissertation of Zhejiang University, 2002


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