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Research on English Teaching of Solar Energy and Photovoltaic Power Generation Technology

Yue-e Chen[1]

[1] School of Foreign Languages, Anhui Jianzhu University
Hefei, China
E-mail: yawoo243@163.com

Abstract. As an emerging energy development industry, solar-photovoltaic power generation technology has the problems of inaccurate translation and translation bias, which affects its long-term development. Therefore, improving the English teaching level of solar-photovoltaic power generation technology majors is an urgent problem to be solved. In order to explore the relationship between solar-photovoltaic power generation technology and the professional practice of English teaching, this paper establishes a vocabulary set of English teaching based on the Clicker calculation model to match the needs of solar-photovoltaic power generation technology majors. Then, combined with teaching theory and intelligent algorithm, the translation constraint feature was used to call and extract data, so as to verify the matching accuracy of solar-photovoltaic power generation technology and English teaching practice. The results show that the matching adjustment coefficients t=-2.822 and df=0.23, and the professional adjustment coefficients t=-3.011 and df=0.85 in the proposed model have significant changes, which are significantly better than those of the manual algorithm. Moreover, the matching accuracy of the Clicker calculation model is more than 95%. The results show that there is a positive correlation between solar-photovoltaic power generation technology and English teaching practice, and the Clicker calculation model can provide support for the matching of solar-photovoltaic power generation technology and English teaching practice.

Key words. Clicker Computing Model, Solar-Photovoltaic Power Generation Technology, English Teaching Practice, Learning Engagement, Relationship Judgment.

1. Introduction

With the rapid development of solar-photovoltaic power generation technology, the integration of solar-photovoltaic power generation technology and teaching practice is emerging. The teaching needs of solar-photovoltaic power generation technology equipment, such as wind power generation parts, hydroelectric equipment, photovoltaic conversion and other fields, are gradually strengthened, so its teaching practice not only includes the transformation of English textbook knowledge, but also includes English practice, the particularity of solar-photovoltaic power generation technology, etc., through intelligent algorithms and models to assist solar-photovoltaic power generation technology English learning, improve the practicality of English teaching. Some scholars believe that photovoltaic energy involves a lot of English teaching knowledge [1]. [2] and has professional particularity, so it is necessary to strengthen the teaching of this profession and integrate ant colony algorithm for vocabulary matching. Some scholars believe that ordinary English teaching cannot meet the professional requirements of solar-photovoltaic power generation technology development, and it is necessary to strengthen English translation and improve the teaching effect. However, there are problems in the practice of intelligent algorithms and models in English teaching practice, which are insufficient to support cases, and the supporting process is complex, which cannot provide strong supporting evidence [3], [4]. Therefore, based on the Clicker calculation model selected in this study, from the perspective of the development of solar-photovoltaic power generation technology, targeted English teaching is carried out, and the English translation framework, learning framework, and integration of solar-photovoltaic power generation technology and English teaching practice are constructed, so as to improve the translation ability of solar-photovoltaic power generation technology professional terms and equipment. Firstly, the integration data set of solar-photovoltaic power generation technology and English teaching practice was constructed, and the professional vocabulary of solar-photovoltaic power generation technology was selected and matched according to the data set, so as to complete the matching and integration of professional vocabulary. Then, combined with the results of the English application of the solar-photovoltaic power generation technology major, the matching accuracy and integration degree were analyzed. Therefore, this study must focus on improving students' ability to apply learning methods [5], [6]. However, at present, the influence of the Clicker computational model in the integration of solar-photovoltaic power generation technology and English teaching practice in colleges and universities has not been deeply explored in the academic field. Therefore, this study will deeply analyze the matching relationship between solar-photovoltaic power generation technology and English teaching practice, find out the mechanism of its impact, and verify the matching results, which will help to provide effective English teaching support for the development of solar-photovoltaic power generation technology.

2. Analysis of Related Issues

A. A Database of the Integration of Solar-Photovoltaic Power Generation Technology Majors and English Teaching

Based on the Clicker calculation model and combined with the high-level feature distribution space [6-8], an English teaching practice application database is constructed, assuming that the database is A_n as shown in equation (1).

$$A_n = a(t_0 + n\Delta t) = h[z(t_0 + n\Delta t)] + \omega_n \tag{1}$$

In equation (1), a represents the basic factor $(t_0 + n\Delta t)$ of the application of solar-photovoltaic power generation technology equipment, the node cycle of the application of solar-photovoltaic power generation technology equipment, the $h[z(t_0 + n\Delta t)]$multiple values of the practical application of English teaching, and ω_n the measurement coefficient of the evaluation error.

In the high-dimensional feature distribution space, the Clicker computational model calculates the English teaching practice vector, obtains the training subset of the evaluation features $S_i(i = 1,2,\cdots,L)$ of English teaching practice, and constructs a computational model for the application of solar-photovoltaic power generation technology equipment to English teaching practice $\sum_{An} = diag(\delta_1,\delta_2,\cdots,\delta_T)$, as shown in equation (2).

$$\sum = diag(\delta_1,\delta_2,\cdots,\delta_T), \delta_i = \sqrt{\lambda_i}, \forall i \neq j \tag{2}$$

In Eq. (2), $\delta = (\delta_1,\delta_2,\cdots,\delta_T)$ the matching vector between English teaching practice and solar-photovoltaic power generation technology is described, and the $\sqrt{\lambda_i}$ attribute matching relationship is expressed [9], [10]. According to the English demand database of solar-photovoltaic power generation technology, the data flow model of language teaching practice and solar-photovoltaic power generation technology equipment is established, and the calculation $D_{in}(\varepsilon)$ formula is shown in (3) for hypothesis 2: the English data flow of solar-photovoltaic power generation technology is as.

$$\begin{aligned} & D_{1n}(\varepsilon) = S\{A(n)\} = 0 \\ & D_{2n}(\varepsilon) = S\{A(n)A(n+\varepsilon)\} = p(\varepsilon) \\ & D_{in}(\varepsilon_1,\varepsilon_2,\cdots,\varepsilon_{n-1}) \equiv 0, n \geq 2 \end{aligned} \tag{3}$$

In equation (3), the initial information representing English teaching practice, the $S\{A(n)\}$ application information of class n $S\{A(n)A(n+\varepsilon)\}$ solar-photovoltaic power generation technology equipment in English teaching practice, and the $\varepsilon = (\varepsilon_1,\varepsilon_2,\cdots,\varepsilon_{n-1})$ continuous functional condition representing the resource distribution level of English teaching practice are the convergence solutions of the application evaluation of English teaching practice by solar-photovoltaic power generation technology equipment.

B. The Vocabulary Matching Relationship between Solar-Photovoltaic Power Generation Technology and English Teaching Practice

The vocabulary of solar-photovoltaic power generation technology and English teaching is matched with quantitative analysis methods in terms of attributes, combined with the specialization of solar-photovoltaic power generation technology sources, such as wind power, photovoltaic power and hydropower, and is expressed in $\sum_{d_i \in TNN} Sim(x,\varepsilon_i)$ combination. Combined with the theory of English word formation, the English content of solar-photovoltaic power generation technology is reconstructed to form a professional English teaching practice plan. Hypothesis 3: The attribute relationship between solar-photovoltaic power generation technology and English teaching is as follows K_{1N} , then the calculation of solar-photovoltaic power generation technology and English teaching practice is shown in equation (4).

$$K_{1N} = \sum_{d_i \in TNN} Sim(x,\varepsilon_i) \cdot y(d_i,\xi_n) \tag{4}$$

In Eq. (4), it represents the $\sum_{d_i \in TNN} Sim(x,\varepsilon_i)$ cognitive recursive process of English teaching, and represents the $y(d_i,\xi_n)$ word reconstruction in the solar-photovoltaic power generation technology major and English teaching practice. In addition, based on English vocabulary, the distribution relationship between English teaching practice and solar-photovoltaic power generation technology is constructed by using the nearest neighbor sample method, and hypothesis 4: the reconstruction relationship between solar-photovoltaic power generation technology and English teaching practice is as $Hx(I,J)$ shown in equation (5).

$$Hx(I,J) = \sum_{I=1}^{n}\sum_{J=1}^{c} \delta_{ig}^{n}(r_{ig})^2 \tag{5}$$

In equation (5), the characteristic index of English teaching practice r_{ig} and the fusion index δ_{ig}^{n} of the application of solar-photovoltaic power generation technology equipment are quantitatively analyzed, and the quantitative recursive feature extraction result x_n of English teaching practice is obtained by combining it with the K value optimization method, as shown in equation (6).

$$x_n = q_0 + \sum_{l=1}^{R_{TY}} q_i x_{n-l} + \sum_{l=1}^{R_{NX}} w_j \phi_{n-l} \tag{6}$$

In equation (6), the sampling amplitude of the initial English teaching practice is represented, the RTY represents the recursive factor, the q_0 sampling amplitude of the ith term, and the scalar time series q_i, and the RNX represents the quantitative factor, x_{n-l} represents the attenuation value of the oscillation, w_j represents the English teaching practice, and ϕ_{n-l} represents the recursive time series.

3. Research Results and Discussion

A. Case Introduction of Solar-Photovoltaic Power Generation Technology and English Teaching Practice

In this paper, we take the solar-photovoltaic power generation technology in the fields of photovoltaic, hydropower, and wind power as the research scope, and analyze their equipment, technical terminology, and translation. At the same time, combined with the theory of cognitive curve and teaching planning scheme, English practice was carried out, and an English vocabulary database was established, with a space of 506M and 1232 English entries. The translation level was based on the fourth level of the university, and the results of word selection, phrase matching, and reading translation accuracy were the results of the study, as shown in Table 1.

Table 1. Data Distribution of Solar-Photovoltaic Power Generation Technology and English Teaching

Dimension	Name	Skewness	Kurtosis	Shapiro-Wilk	
				Statistic W Value	p
Solar-Photovoltaic Power Generation Technology	Wind Power	-0.017	-1.109	0.959	0.012*
	Water Power	0.112	-1.188	0.952	0.005**
	Photovoltaic	0.135	-1.212	0.948	0.003**
	Synthesis	0.122	-0.932	0.971	0.061
Teaching in English	Word	0.001	-1.090	0.964	0.024*
	Phrase	-0.227	-1.215	0.937	0.001**
	Read	-0.135	-1.384	0.928	0.000**
	Clause	-0.093	-1.076	0.960	0.014*

From the data analysis in Table 1, it can be seen that the data involved in the survey covers a wide range of data, which can be used as the results of correlation analysis in the later stage. Moreover, the dispersion of the sample data is 0.852, which meets the analysis requirements.

B. The Degree to Which Solar-Photovoltaic Power Generation Technology is Compatible with English Teaching Practice

In this study, the Clicker model was used as the independent variable, and the vocabulary, phrase, and reading dimensions were used as the dependent variables, and the matching results were analyzed, as shown in Table 2.

Table 2. Matching of Solar-Photovoltaic Power Generation Technology Sources and English Teaching

Index	Illustrate	Test Them Separately	Match Analysis
R-Squared Value	The larger the fit degree index, the larger the better	1.000	-2.601
Mean Absolute Error Value MAE	L1 loss, the difference between the mean value of the true value and the fitted value, the closer to 0 the better	0.000	3.072
Mean Square Error (MSE).	L2 loss, the sum of squares of the error, the closer to 0 the better	0.000	9.456
Root Mean Square Error RMSE	MSE root number, average gap value	0.000	3.075
Median Absolute Error MAD	The predicted value is the absolute value from the median residual, which is not affected by outliers, and the smaller the better	0.000	3.072
The Average Absolute Percentage Error MAPE	The average percentage of error, not affected by outliers, the smaller the better	0.000	0.038
Interpretable Variance EVS	The measure of how well the model explains the fluctuations in the data, between [0,1], the larger the better	1.000	-2.593
Root Mean Square Logarithmic Error MSLE	When the RMSE is the same, the underprediction penalty is more (used less)	0.000	0.876
Collectivity		8.21%	98.32%
Note: The current model fits the R side with a <0, which is normal in principle, and it is recommended to ignore this indicator.			

As can be seen from Table 2, the matching results between solar-photovoltaic power generation technology and English teaching practice are good, with the coincidence rate of each test being 8.21% and the accuracy of matching analysis being 98.32%. The relationship between the different results was calculated by in-depth analysis of different contents, and the results are shown in Figure 1.

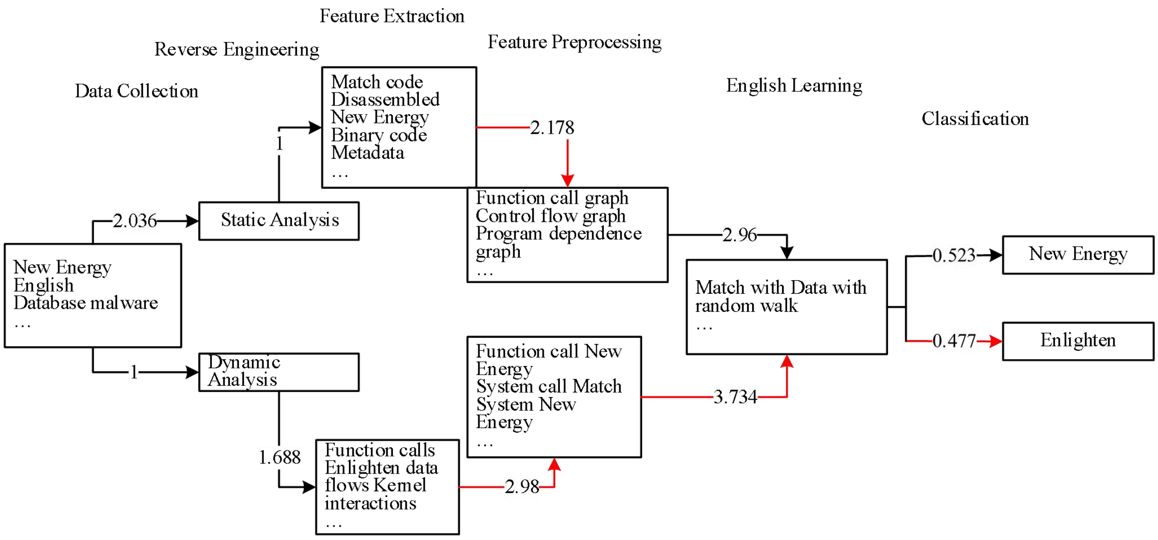

Fig. 1. Decision-Making Process for Different Contents

As can be seen from the content in Figure 1, the integration effect between solar-photovoltaic power generation technology and English teaching practice is good, and the integration coefficient is 3.734 and the matching coefficient is 2.98. The final test results of solar-photovoltaic power generation technology and English teaching practice are 0.523 and 0.477, indicating that the final matching results pay more attention to solar-photovoltaic power generation technology and meet the expected analysis requirements. In addition, the independence of solar-photovoltaic power generation technology and English teaching is analyzed, and the results are shown in Table 3.

Table 3. Independence Analysis of Solar-Photovoltaic Power Generation Technology and English Teaching

Range	The Name of the Parameter	Parameter Value
Professionalism	Data Preprocessing	None
	Proportion of the Training Set	0.8
	Node Splitting Criteria	Squared_Error
Match Content	How Nodes are Divided	Best
	The Minimum Number of Samples for Node Splitting	2
	Minimum Number of Samples for Leaf Nodes	1
Overall	Maximum Depth of the Tree	No Limit

At the same time, through the independent sampling t-test, this study found that there was a significant difference in learning engagement between students who used university and those who did not use university ($T=2.259$, $df=320$, $p<0.05$). Among them, the learning investment of college students was significantly higher than that of non-college students ($MD=0.19$). The Clicker computational model can effectively improve the translation level of solar-photovoltaic power generation technology. There was no significant difference in the degree of improvement of English teaching practice, and there was no significant difference in the calculation assisted by the Clicker calculation model ($T=1.376$, $df=320$, $p>0.05$). The Clicker computational model cannot improve students' learning participation in the integration of solar-photovoltaic power generation technology and English teaching practice. From the perspective of behavioral understanding, there was a significant difference between students who used university and those who did not ($t=2.890$, $df=320$, $p<0.05$), and the participation of students who used university was significantly higher than that of students who used other methods ($MD=0.24$). The application of the Clicker computational model has significantly improved students' behavioral understanding of the integration of solar-photovoltaic power generation technology and English teaching practice. These observations are generally consistent with previous studies that depict how the Clicker computational model can improve the accuracy of translation, but there are still some differences. With the help of the Clicker calculation model, users can be better in terms of behavior understanding than users who do not use the Clicker calculation model. This is mainly due to the fact that the Clicker calculation model can quickly publish the completion status of a task after a user submits a question, while explaining and analyzing it in detail. This excellent real-time feedback responds quickly and powerfully to student needs, giving students a clear picture of where they are in the preparation phase and making appropriate changes to their learning strategies. On the other hand, the Clicker computing model conforms to the English translation thinking mode, which can translate equipment and content more deeply, promote in-depth understanding of the curriculum, and realize the matching of solar-photovoltaic power generation technology and English teaching. With the assistance of the Clicker calculation model, the differences between solar-photovoltaic power generation technology majors are small, which is due to the inherent characteristics of the combination of solar-photovoltaic power generation technology and English teaching practice. The integration of solar-photovoltaic power generation technology and English teaching practice is regarded as the teaching goal, and the translation of solar-photovoltaic power generation technology and English teaching is promoted, and the integration point of the two is iterated, so the independence and integration between solar-photovoltaic power generation technology and English teaching are strongly correlated.

C. The Depth of Integration of Solar-Photovoltaic Power Generation Technology and English Teaching Practice

In this study, we conducted an in-depth analysis of multiple sets of structural equation models with the depth of integration as the external factor, the investment in solar-photovoltaic power generation technology, English teaching practice and behavioral cognition as the internal factors, and the application of the Clicker calculation model as the moderating factor. After the collected information is calibrated as necessary, a statistical analysis of the Clicker calculation model is performed. The preliminary calibration results show that solar-photovoltaic power generation technology and English teaching are two external factors, and the relationship between the two is very close, leading to the resonance of subsequent integration. In order to reduce the depth of fusion in the fusion process, data from previous studies were drawn, and exploratory factor analysis was used to determine the depth of fusion between the two, and the specific results are shown in Table 4.

Table 4 The Depth of Integration between Solar-Photovoltaic Power Generation Technology and English Teaching Practice

Convergence Projects	**Fusion Depth**
Wind Power	80.166
Waterpower	80.446
Photovoltaic	80.124
Synthesis	80.264
Word	80.321
Phrase	82.655
Read	87.622
Clause	79.325

The results showed that the information and data of extrinsic variables (including positive and negative evaluations) and intrinsic variables (such as emotional engagement and behavioral cognitive participation) met the basic criteria of the evaluation model. The factor load of all models was greater than 0.50 and all reached the significance level ($p<0.05$). After completing the previous statistical tests, the study concluded that the data met the preset conditions of the Clicker calculation model and could be used for a formal study. This study initially used this model to study how two external variables affect two internal variables (see Figure 2). The results show that the data supported by the Clicker calculation model has good matching, and all other influencing factors are of obvious importance except for the impact of negative evaluation on learning participation and behavior understanding ($p<0.05$).

D. Correlation Analysis between Solar-Photovoltaic Power Generation Technology Equipment and English Teaching Practice

In this study, three main variables, performance expectation, effort expectation, and attitude to action, were selected as independent variables, and student evaluations provided by the Clicker calculation model were used as dependent variables. Then, a single-element-based within-group ANOVA was performed to determine if there were significant differences between the three main variables. The specific results are shown in Table 5.

Table 5 Differences in the Scores of the Three Self-Dimension Correlations of the Clicker Calculation Model

Index	**Average Value**	**Variance**
Solar-Photovoltaic Power Generation Technology	83.452	0.254
English Teaching Practice	78.621	0.324
Fusion Relevance	75.655	0.722

Through the model study of multiple population structures, this study found that the standard regression coefficient of fusion depth evaluation for English practice was ($t=-0.34$, $p<0.05$), while in practice, the coefficient was ($t=0.12$, $p<0.25$). Similarly, in the fusion depth understanding, the negative evaluation coefficient in standard regression is ($t=-0.39$, $p<0.05$), while in practice, the coefficient is 0.15. Although none of these parameters met expectations, when the study compared them with the English words and phrases supported by the Clicker calculation model, it was found that there was a significant difference between the two groups in the translation content evaluation ($t=-2.822$, $DF=320$, $P<0.05$), while in the content and vocabulary translation, there were significant differences in the translation and matching coefficients between the two groups ($t=-3.011$, $df=0.320$, $p<0.05$). Among the students who were not supported by the Clicker computational model, the integration evaluation of solar-photovoltaic power generation technology had a deeper impact on their enthusiasm for English teaching practice. This further confirms that the Clicker computational model can improve the depth of integration between solar-photovoltaic power generation technology and English teaching practice. According to the research, the main factors leading to these achievements include: first, the Clicker model can provide immediate feedback for the English translation of solar-photovoltaic power generation technology, deepen the hierarchy of solar-photovoltaic power generation technology translation, promote independent learning, and improve the integration of English and solar-photovoltaic power generation technology; Second, the Clicker model can also present formative evaluation information to teachers, thereby enhancing the application of English teaching. After receiving an in-depth assessment of integration, the English teaching practice will deeply adapt the learning method and track the progress of solar-photovoltaic power generation technology translation. Starting from interactivity, the interactive framework and practical framework provided by the Clicker computing model reduce the complexity of English translation and enhance the iterative ability of solar-photovoltaic power generation technology and English teaching. After the analysis of variance (ANOVA) was performed on phrases and phrases, the Clicker calculation model was used to assist the evaluation of solar-photovoltaic power generation technology in three sub-dimensions, and there was no significant difference in the results ($F=2.318$, $p<0.05$). The comparative data of multiple indicators showed that the English translation level of the solar-photovoltaic power generation technology major was significantly higher than that of the non-intervention group ($MD=0.28$, $p<0.05$), the integration depth of solar-photovoltaic power generation technology and English teaching practice was significantly better than that of the previous method ($MD=0.17$, $p<0.05$), and the score of solar-photovoltaic power generation technology translation was significantly higher than that of the previous method ($MD=0.11$, In other words, through the analysis of the Clicker calculation model, the English translation process of the solar-photovoltaic power generation technology was simpler. Moreover, the uniqueness of the noun is high. However, some scholars believe that the application of the Clicker computational model may reduce the integration point of solar-photovoltaic power generation technology and English teaching practice, and whether it has practical value. However, the results of this paper show that the Clicker computational model does not have any technical difficulties, and can quickly read to find the connection between solar-photovoltaic power generation technology and English teaching practice, which can change the existing translation situation, and find the main factors that determine the integration of solar-photovoltaic power generation technology and English teaching practice. On the other hand, the innovative evaluation provided by the Clicker computational model can reduce the complexity of the integration of solar-photovoltaic power generation technology and English teaching, and can improve the level of solar-photovoltaic power generation technology translation.

4. Conclusion

As a new field, solar-photovoltaic power generation technology needs the support of English teaching practice to improve the professionalism of solar-photovoltaic power generation technology. The results show that the initial data volume coefficients $t=-2.822$ and $df=320$, and the fusion depth coefficients $t=-3.011$ and $df=320$ of the Clicker calculation model have significant changes, indicating that the model can promote the fusion of the two. In addition, the Clicker computational model reduces the complexity of the integration of solar-photovoltaic power generation technology and English teaching, improves the enthusiasm of English teaching practice, has a significant impact on the development of solar-photovoltaic power generation technology translation, and provides a direction for the development of English teaching practice, which shows that the correlation between solar-photovoltaic power generation technology equipment and English teaching practice is significant, and the accuracy of translation can be improved. Due to the wide range of solar-photovoltaic power generation technology and English teaching, the large amount of data and the difficulty of finding key indicators are difficult to find, so this study will continue to broaden the investigation field of this study in the future, further clarify the relationship between solar-photovoltaic power generation technology and English teaching practice, and lay a solid foundation for subsequent related research.

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