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Original Research

Evaluation of Digital Technology Integration into University Teaching Acceptance in the Context of Green and Sustainable Development

Haixia Guo[1*], Hui Feng[1], Gang Zeng[2***], Qingchao Zeng[1]**

[1]School of foreign languages, Tianjin University, Tianjin 300350, China
[2]School of economics and management, Civil Aviation University of China, Tianjin 300300, China

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Abstract

Environmental pollution, ecological destruction, and waste of resources are increasingly threatening human existence. The Chinese government has set the goal of "carbon peaking by 2030 and carbon neutrality by 2060" to promote green and sustainable development. Under the background of the green and digital era, it is necessary to promote green and sustainable higher education. It is of great theoretical and practical value to discuss the acceptability of green technology in higher education teaching. This paper takes the acceptance evaluation of green technology into college foreign language teaching as the object, constructs the acceptance evaluation index system based on the Delphi method, selects the entropy weight TOPSIS model to evaluate the acceptance, and finally tests the main factors affecting the acceptance through the whole and grouping regression models. The main conclusions are as follows: (1) Based on the Delphi method, a five-dimensional acceptance evaluation index system including "teaching mode, teaching skills, teaching ideas, teaching content, and teaching effects" can be constructed. (2) Based on the entropy weight TOPSIS model, it is found that the relative proximity Z value of the acceptance of green technology into college foreign language teaching has significant heterogeneity. (3) Through multiple linear regression analysis, it can be found that the evaluation subjects' dependence on green technology, imagination, educational equity, and interpersonal interaction have the greatest impact on their acceptance. The scientific and rational use of green technology tools such as digital technology will become a possible direction for the reform of intelligent foreign language teaching.

Keywords: sustainable development, dual carbon target, green technology, foreign language teaching, acceptance evaluate

*email: haixia.guo@tju.edu.cn
**email: fenghui@tju.edu.cn
***email: gzeng666@foxmail.com

Introduction

Environmental pollution, ecological destruction, and waste of resources are increasingly threatening human existence. In September 2020, at the 75th session of the United Nations General Assembly, the Chinese government committed to the goal of "peaking CO_2 emissions by 2030 and achieving carbon neutrality by 2060." To achieve the carbon peak, China needs to increase the share of non-fossil energy consumption to 25% and reduce carbon emissions per unit of GDP by over 65% compared with 2005. To achieve this goal, China has vigorously promoted sustainable development and actively developed green industries.

Green technology is an important tool to realize sustainable development in higher education. With the rapid development of artificial intelligence and digital technology, green technology has brought new opportunities and challenges to the development of higher education. The typical green technology with digital technology will bring new changes to the development of higher education. Green technology has the characteristics of high efficiency, convenience, and greenness, which can save resources and improve learning and working efficiency. But this green technology may also raise ethical questions. Therefore, it is of great theoretical and practical value to discuss the acceptability of green technology in higher education teaching.

Digital technology as a digital intelligence technology, it will bring opportunities and challenges to higher education teaching activities. From the perspective of opportunities, digital technology can greatly improve the efficiency of teaching and research activities, reduce the waste of resources, and save the cost of information collection [1, 2]. However, digital technology will also raise many ethical and integrity issues. Some educators worry that if students use digital technology to write assignments, reports, or even academic papers, it will lead to great educational inequity [3]. Because Digital technology is a new thing in the field of artificial intelligence, the academic research on it is still in the discussion stage, and there are few references in the field of foreign language teaching. However, from the perspective of existing studies, most of them focus on the convenience, moral issues, and risks of digital technology [4-6].

Many achievements have been derived from the convenience research around digital technology. Hu et al. (2023) believe that the interactive function of digital technology is helpful in inspiring students' thinking, exploring problems, and using the situational simulation function of digital technology to improve students' ability to degree consideration problems ability [7]. Ma and Liang (2023) believe that digital technology helps international Chinese education form an open and resilient digital ecosystem [8]. Wang (2023) believes that using artificial intelligence tools to build digital technology + MTPE, has a significant effect on the training of compiler talents, which helps to comprehensively improve students' post editing strategies and abilities [9]. Dai et al. (2023) believed that digital technology would help improve the effectiveness of teaching, learning, management, and evaluation [10]. These studies mainly focus on the analysis of digital technology's empowerment of traditional education, which has important enlightening value.

However, the ethical and risk issues that may arise from digital technology are also the current focus. AI tools represented by digital technology may lead to the alienation of college students' spirit, the decline of innovation ability, the invasion of students' privacy, and other practical problems [11]. From the perspective of the existing functional attributes of digital technology, digital technology tools cannot participate in the moral quality, knowledge character, and other aspects of students' moral education, but play a more instrumental role [12]. Digital technology has an impact on talent cultivation in colleges and universities, which will lead to difficult problems such as the lack of initiative in learning subjects and the technicalization of education evaluation [13]. For traditional business education, digital technology, and other new technologies will have a strong impact on its research ability, mode, and publication [14]. Digital technology is a heterogeneous technology. If it cannot be reasonably used, it may lead to the harm of depriving students of cognition [15]. Embedding digital technology into the education system will lead to deviations in creation, understanding, and personalization. It is necessary to coordinate the relationship between teachers and AI tools [16]. If digital technology is rudely introduced into teaching, it will lead to a "chain reaction" of many factors, which will produce uncertainty risk on human brain representation [17]. In order to maintain the "good" mission of education, it is necessary to prevent the ethical risk of digital technology, improve AI technology, and promote the effectiveness of man-machine collaborative education [18]. The above research mainly systematically analyzes the possible risks and challenges of digital technology to education and teaching, deeply discusses the possible impact of generative AI technology, and puts forward some constructive measures.

To sum up, scholars at home and abroad have carried out dialectical analyses around the integration of digital technology into education and teaching. In the era of digital intelligence, digital technology, and other AI tools have reached a consensus on the impact of digital technology on the education model and put forward critical thinking and opinion countermeasures for the possible ethical risks and governance crises in different aspects of education and teaching. However, most of the studies are analyzed from a qualitative perspective and systematically elaborated from the perspectives of educational law, digital empowerment, educational ecology, and personnel training. Few studies carry out empirical analysis from the perspective of "student-centered".

There are few evaluation results on the acceptance of digital technology into college foreign language teaching, and the empirical analysis combined with survey data is insufficient. Therefore, the main innovations of this paper are as follows: (1) analyzing the frontier issues of digital technology integrated into the teaching reform mode of higher education, which has a unique perspective of innovation. (2) Different from the existing achievements that only focus on the opportunities and challenges of digital technology for education and teaching, this paper mainly carries out empirical analysis from the perspective of teacher-student acceptance, which has a clear target. (3) This paper introduces the Delphi method, the entropy weight TOPSIS model, the grouping regression model, and other methods to comprehensively analyze the acceptance evaluation index system, measurement results, and influencing factors of digital technology in college foreign language teaching. The results based on empirical analysis are more objective. In the logarithmic intellectual age, it provides an important reference for the reform of foreign language education and teaching in colleges and universities.

Material and Methods

Construction of the Evaluation Index for the Acceptance of Digital Technology in Foreign Language Teaching

Digital technology is a typical representative of generative AI tools. The integration of digital technology into foreign language teaching has both advantages and disadvantages. At present, there is no mature evaluation index system for the acceptance of digital technology into foreign language teaching. Therefore, it is necessary to introduce the Delphi method to form a set of operable evaluation indicators according to the judgment of experts in foreign language teaching in colleges and universities.

The Delphi method was first proposed by the famous Rand Corporation. It was applied in business research earlier and then gradually expanded to scientific research, education, and teaching [19]. The main idea of the Delphi method is to invite multiple experts who are proficient in a certain problem, and the experts will evaluate the research problem according to their professional ability. Usually, experts make judgments in an independent manner. The research organizer will collect the information feedback from all experts, eliminate invalid information, and finally realize the convergence of opinions around the research topic [20, 21]. Due to the lack of research on the acceptance of digital technology in foreign language teaching, the advantage of the Delphi method is that it can be applied to solve such problems. Therefore, the Delphi method has unique advantages in the selection of indicators.

Referring to relevant research [22-24], the basic steps of the Delphi method are as follows:

Preliminary design of step 1 index.

A preliminary scale was designed based on the literature related to the topics of “Digital technology”, “College foreign language teaching”, “teaching evaluation”, etc. The scale constructs the basic index system from the dimensions of teaching content, teaching technology, and teaching effect. At the same time, in the process of questionnaire design, the Likert scale was used to design relevant questions.

Step 2 Select experts.

Using the method of non-probability sampling, experts with expertise in the field of foreign language education and teaching in colleges and universities are selected to carry out the survey. Usually, the experts have a doctor’s degree or a professional title of lecturer or above. At the same time, in order to ensure the rationality of the indicators, some experts in computer, management, and other professional fields are recruited to supplement, and the reliability of the results is ensured by absorbing experts from interdisciplinary disciplines.

Step 3 Consultation.

Multiple rounds of surveys were conducted by means of electronic questionnaires. In the first round, let experts express their opinions on the scientificity and rationality of relevant indicators. The second round and the third round of supplementary research on several theories mainly focused on the summary of expert opinions and supplementary research. In particular, when the experts’ opinions are different, the on-site interview can be used to clarify the indicators.

Step 4 Determination of index system.

Fully absorb the opinions of experts and form a multi-dimensional index system for the integration of digital technology into foreign language teaching acceptance evaluation on the basis of literature.

Construction of the Acceptance Model of Digital Technology into Foreign Language Teaching

Because of the lack of acceptance of digital technology in foreign language teaching, there is no direct reference data, and the evaluation of such problems belongs to the type of multi-objective decision-making. Therefore, consider leading into the entropy weight TOPSIS Model Conduct as an assessment. The entropy weight method has the advantage of objectivity and effectiveness by means of objective assignment and entropy to describe the degree of information. The TOPSIS model achieves the ranking of results by comparing them with the ideal value. The entropy weight TOPSIS model is widely used in the fields of education evaluation, and economic evaluation [25, 26].

Refer to relevant research [27, 28]; the entropy weight TOPSIS Model modeling process is as follows:

Step 1 Establish a standard evaluation model.

Based on the evaluation index system constructed by the Delphi method, the initial evaluation index matrix

of the acceptance of digital technology into foreign language teaching is established.

$$X = \begin{vmatrix} x_{11} & x_{12} \cdots x_{1n} \\ x_{21} & x_{22} \cdots x_{2n} \\ \vdots & \vdots \cdots \vdots \\ x_{m1} & x_{m2} \cdots x_{mn} \end{vmatrix}$$

Furthermore, the normalized matrix K: K is obtained by the normalization method.

$$K = \begin{vmatrix} r_{11} & r_{12} \cdots r_{1n} \\ r_{21} & r_{22} \cdots r_{2n} \\ \vdots & \vdots \cdots \vdots \\ r_{m1} & r_{m2} \cdots r_{mn} \end{vmatrix}$$

In the above Equation, when the I individual is equal to the J of the indicator individual, the initial value is the corresponding standardized value.

Step 2 Determines the weights of different indicators.

Using the entropy weight method, it can effectively estimate the degree of variation of different indicators, usually using information entropy to feedback, according to entropy weight theory. The information entropy of different indicators is as follows:

$$G_i = -In(n)^{-1} \sum_{i=1}^{n} q_{ij} Inq_{ij}$$

In the above Equation, if there is, then we can get.

The entropy weight method can be used to estimate the variation degree of different indexes effectively. Information entropy is usually used for feedback. According to the entropy weight theory, the information entropy G_i of different indicators is as follows:

$$W_i = \frac{1 - G_i}{m - \sum G} (i = 1 \cdots m)$$

Step 3 Setup Based on entropy weight evaluation matrix F.

In order to ensure the accuracy of the evaluation results and reduce the error as much as possible, the weighted method can be used to establish a standardized evaluation matrix F. The specific methods are as follows:

$$F = \begin{vmatrix} f_{11} & f_{12} \cdots f_{1n} \\ f_{21} & f_{22} \cdots f_{2n} \\ \vdots & \vdots \cdots \vdots \\ f_{m1} & f_{m2} \cdots f_{mn} \end{vmatrix}$$

Therefore, the weighted matrix can be obtained:

$$F = \begin{vmatrix} f_{11}.\mathrm{w}_1 & f_{12}.\mathrm{w}_1 \cdots f_{1n}.\mathrm{w}_1 \\ f_{21}.\mathrm{w}_2 & f_{22}.\mathrm{w}_2 \cdots f_{2n}.\mathrm{w}_2 \\ \vdots & \vdots \cdots \vdots \\ f_{m1}.\mathrm{w}_m & f_{m2}.\mathrm{w}_m \cdots f_{mn}.\mathrm{w}_m \end{vmatrix}$$

Step 4 Determining positive and negative ideal solutions.

If F^+ is the maximum value in the estimate, then it can be taken as the maximum value of the i index in the jth dimension, that is, the positive ideal solution, with the best preference; conversely, if F^- is the smallest value in the estimate, then it can be taken as the smallest value of the i index in the j[th] dimension, that is, the negative ideal solution, with the least ideal preference. The calculation Equation for and is as follows:

$$F^+ = \left\{ \max_{1 \ll i \gg} f_{ir} \middle| i = 1 \cdots m \right\} = \left\{ F_1^+, F_2^+, \cdots, F_m^+ \right\}$$

$$F^- = \left\{ \min_{1 \ll i \gg} f_{ir} \middle| i = 1 \cdots m \right\} = \left\{ F_1^-, F_2^-, \cdots, F_m^- \right\}$$

Step 5 Calculate positive and negative ideal distances.

There are many methods of distance calculation, but the most classic method is the Euclidean distance method. Therefore, this paper studies the use of this algorithm for measurement of the method as follows: suppose S_j^+ is the distance between index i and F_j^+, S_j^- is the distance between index i and F_j^-, the following equations can be obtained, respectively:

$$S_j^+ = \sqrt{\sum_{i=1}^{m} (F_j^+ - F_{ij})^2}$$

$$S_j^- = \sqrt{\sum_{i=1}^{m} (F_j^- - F_{ij})^2}$$

In the above formula, F_{ij} represents the value of the i index after weighted calculation in the j[th] dimension; S_j^+ and S_j^- represent the best and least preferred values of the i indicator in all evaluations, respectively.

Step 6 Calculate the closeness of the evaluation value to the ideal value.

Suppose that Z_j represents the optimal level of the i[th] evaluation object's acceptance of digital technology, which can also be called the "proximity degree", $Z_j \in [0,1]$. The formula for calculating Z_j is as follows:

$$Z_j = \frac{F_j^-}{F_j^+ - F_j^-}$$

When Z_j = 1, it means that the evaluation object can fully accept the integration of digital technology into foreign language teaching.

When $0<Z_j<1$, it means that the higher the evaluation object's value of integrating digital technology into foreign language teaching, the higher the acceptance degree;

When Z_j = 0, it means that the evaluation object cannot accept the integration of digital technology into foreign language teaching at all.

The Influencing Factor Model of the Acceptance of Digital Technology in Foreign Language Teaching

In order to explore the main factors affecting the acceptance of digital technology in foreign language teaching, we can consider introducing the multiple linear regression model in statistics. The model can map the degree of influence according to the correlation between different influencing factors.

Referring to relevant research [29], we can get the expression of the multiple linear regression model for the acceptance of digital technology into foreign language teaching:

Suppose that there are t_1, t_2, ..., t_m factors affecting acceptance and Z influencing factors of acceptance, then the influence formula of the independent variable $t_i(i = 1, 2, ..., m)$ on dependent variable Z is as follows:

$$Z = l_o + l_1 t_1 + l_2 t_2 + \cdots + l_m t_m + \varepsilon$$

In the above Equation, l_o is the constant term, l_1, l_2, ..., l_m is the coefficient of t_1, t_2, ..., t_m respectively, and ε represents the random error term.

Through multiple surveys, we can get k observations of t_1, t_2, ..., t_m, then we get the k observation t_{i1}, t_{i2}, ..., t_m, Z_i. Where i = 1, 2, ..., k. Therefore, the following Equation can be obtained:

$$\begin{cases} Z_1 = l_o + l_1 t_{11} + l_2 t_{12} + \cdots + l_m t_{1m} + \varepsilon_1 \\ Z_2 = l_o + l_2 t_{21} + l_2 t_{22} + \cdots + l_m t_{2m} + \varepsilon_2 \\ \cdots \\ Z_n = l_o + l_n t_{n1} + l_2 t_{n2} + \cdots + l_m t_{nm} + \varepsilon_n \end{cases}$$

Finally, the estimation of l_0, l_1, l_2, ..., l_m can be obtained by using the least squares estimation method.

Data Acquisition Method

This paper mainly obtains data through a questionnaire survey. Specifically, it is divided into two stages: (1) the stage of determining the index system. A data survey on the integration of digital technology into the acceptance index system of foreign language teaching in colleges and universities based on the Delphi method. This paper mainly selected teachers engaged in foreign language teaching and professional English teaching in several universities in Tianjin to conduct a questionnaire. Through multiple rounds of questionnaire consultation, the research index system was determined. The collection time was from September to October 2023, lasting 36 days. (2) Teacher-student survey stage. As the integration of digital technology into college foreign language teaching is a new thing, teachers and students accept, the degree for the future of teaching reform is of great significance. Based on the "student-centered" teaching idea, the second stage of the questionnaire survey is mainly for teachers engaged in foreign language teaching and some students participating in the course. From October to November 2023, the survey lasted 15 days. Students in foreign language teaching classes in several universities in Tianjin were randomly sampled. 300 students were randomly selected to conduct the survey. Finally, 286 questionnaires were collected, with a recovery rate of 95.6% and a recovery rate of more than 90%. After data cleaning, invalid questionnaires were eliminated, and 257 valid questionnaires were finally obtained, with a validity of 94.5%.

Results and Discussion

Evaluation Index Results of the Acceptance of Digital Technology in Foreign Language Teaching

Evaluation Index System

In order to get a reasonable evaluation index system for the integration of digital technology into foreign language teaching acceptance, this paper first refers to the achievements related to students' learning and education at home and abroad, and at the same time refers to the model theory of satisfaction evaluation, and finally determines to build the acceptance evaluation index system from five dimensions: A teaching mode, B teaching skills, C teaching ideas, D teaching content, and E teaching effect.

The acceptance evaluation index system as shown in Table 1 is finally formed through multiple rounds of the Delphi research and expert consultation.

Questionnaire Survey Results

According to the acceptance evaluation index of digital technology in foreign language teaching, 257 teachers completed the Germinal Expansion Questionnaire Survey. Through data statistics, the reliability coefficient of the questionnaire is 0.944, greater than 0.9, which shows that the questionnaire has good reliability, and the analysis using the questionnaire is reliable.

In addition, the CITC values of the analysis items

Table 1. Digital technology in foreign language teaching acceptance evaluation index system.

Primary indicator	Secondary index	Tertiary indicators
Acceptance index of digital technology into college foreign language teaching	A teaching mode	A11 what do you think of digital technology? What is your score for English knowledge?
		A12 how do you rate digital technology's ability to reform and innovate the English education model?
	B teaching skills	B11 how do you rate digital technology for improving the speed of English information acquisition?
		B12 do you rate digital technology for the weight reduction of English papers?
		B13 how do you rate digital technology for improving English writing ability?
	C teaching ideas	C11 how do you rate the ideas and methods of English teaching that digital technology can provide?
		C12 what is your acceptance of digital technology replacing traditional English teaching methods?
	D teaching content	D11 how do you rate the graphic expression of digital technology that is helpful for English teaching?
		D12 how do you rate digital technology for correcting errors in English grammar?
	E teaching effect	E11 what is your rating of digital technology for the future development of English education?
		E12 how do you rate the teaching effect of digital technology in improving English education?

were greater than 0.4, indicating that there was a good correlation between different variables, which further verified the reliability of the questionnaire.

In order to intuitively display the survey results, the survey results of "A11, your rating of digital technology will expand your English knowledge?", "A12, your rating of digital technology can reform and innovate the English education mode?", "B11, your rating of digital technology can improve the speed of English information acquisition?", and "E12, your rating of digital technology can help improve the teaching effect of English education" were selected to draw a scatter diagram, as shown in Fig. 1.

From the perspective of data distribution, respondents have similar answers about the possible effect of digital technology in foreign language teaching. The scatter distribution of the four graphs in Fig. 1(a-d) is relatively consistent, and there are fewer extreme values with too high or too low scores. Therefore, it can be seen preliminarily that many

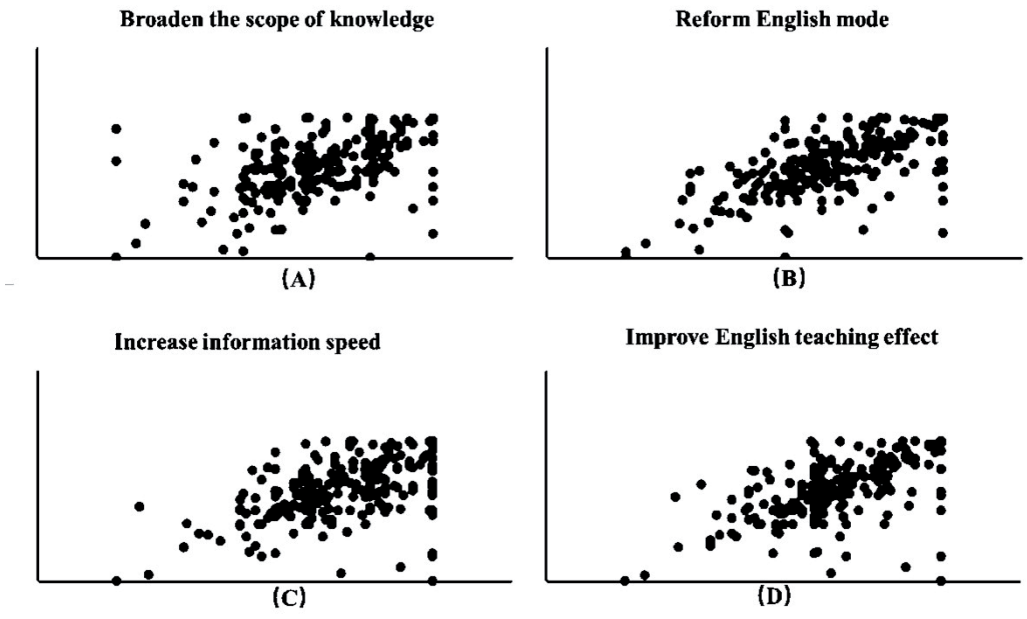

Fig. 1. Scatter diagram of four indicators.

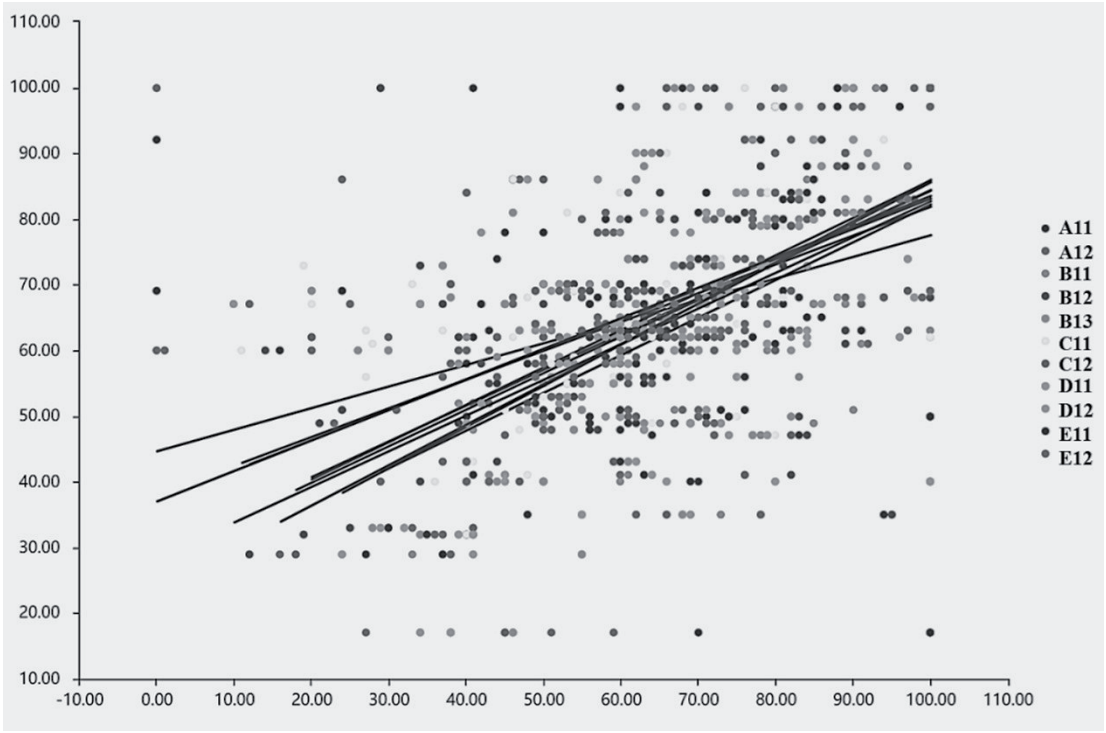

Fig. 2. Scatter diagram of 11 indicators.

teachers and students recognize the positive role of digital technology in foreign language teaching.

Further, the 11 indicators "A11, your score on digital technology will expand your English knowledge?", "A12, your score on digital technology can reform and innovate the English education mode?", "B11, your score on digital technology can improve the speed of English information acquisition?", "B12, your score on digital technology can reduce the weight of English papers?", "B13, your score on digital technology can improve English writing ability?", "C11, your rating of digital technology's ability to provide English teaching ideas and methods?", "C12, your acceptance of digital technology's substitution of traditional English teaching

Table 2. Weight results calculated by the entropy method.

Term	Information entropy G	Information utility value D	Weight coefficient w
A11 what do you think about digital technology? What is your English knowledge score?	0.9893	0.0107	9.39%
A12 how do you rate digital technology's ability to reform the English education model?	0.9887	0.0113	9.95%
B11 how do you rate digital technology for improving the speed of English information acquisition?	0.9918	0.0082	7.16%
B12 do you rate digital technology for weight reduction of English papers?	0.9877	0.0123	10.79%
B13 how do you rate digital technology for improving English writing ability?	0.9864	0.0136	11.95%
C11 how do you rate digital technology for improving English teaching ideas?	0.9914	0.0086	7.55%
C12 what is your acceptance of digital technology replacing traditional English teaching?	0.9856	0.0144	12.64%
D11 how do you rate the graphic expression of digital technology that is helpful for English teaching?	0.9904	0.0096	8.40%
D12 how do you rate digital technology for correcting errors in English grammar?	0.9913	0.0087	7.61%
E11 what is your rating of digital technology for the future development of English education?	0.9918	0.0082	7.18%
E12 how do you rate digital technology for improving English teaching?	0.9916	0.0084	7.36%

methods?", "D11, your rating of digital technology's graphic expression that helps English teaching?", "D12, your rating of digital technology's ability to correct English grammar errors?", and "E11, your rating of digital technology's ability to help the future development of English education?". See Fig. 2 for the scatter plot of the score result of "E12, your score of digital technology is helping to improve the teaching effect of English education?". From the results, the distribution area of scores of different indicators, such as inter comparison, is consistent.

Evaluation Results of the Acceptance of Digital Technology in Foreign Language Teaching

As described in Material and Methods, the entropy weight of the TOPSIS algorithm, according to the survey data, can get the value of information entropy, positive, and negative ideal solutions, and the relative proximity of digital technology in the acceptance evaluation of foreign language teaching.

Table 2 shows the weight results calculated by the entropy method. From the results, the information entropy value of "A11, how do you rate digital technology to expand your knowledge of English?" is 0.9893, the information utility value is 0.0107, and the weight coefficient is 9.39%, indicating A11's acceptance of the evaluation object degree action was larger than 8%. Overall, the information entropy g of "C12, what is your acceptance of digital technology replacing traditional English teaching?". The information utility value D and weight coefficient W are 0.9856, respectively, and 0144 and 12. 64%. The weight value was the highest, being greater than 10%. This shows that with the development of AI computing, especially the iteration of generative AI tools such as digital technology, the traditional foreign language teaching mode will usher in significant changes, and teachers and students have a high acceptance of this trend. "B11, your rating of digital technology can improve the speed of English information acquisition?", "E11, your rating of digital technology can help the future development of English education?", "C11, your rating of digital technology can improve English teaching ideas?". The weight coefficients of these three indicators are 7.16%, 7.18%, and 7.55%, respectively, and the weight values are lower than 7.6%, indicating that these indicators are of low importance in the evaluation object.

Table 3. TOPSIS evaluation calculation results.

term	Positive ideal Solution distance S+	Distance of negative ideal solution S-	Relative proximity Z	Sort results
Evaluation object 154	0	30.806	1	1
Evaluation object 130	0	30.806	1	1
Evaluation object 126	0	30.806	1	1
Evaluation object 86	0	30.806	1	1
Evaluation object 65	0	30.806	1	1
Evaluation object 43	0	30.806	1	1
Evaluation object 23	0	30.806	1	1
Evaluation object 7	0	30.806	1	1
Evaluation object 202	0.12	30.76	0.996	9
Evaluation object 172	0.286	30.647	0.991	10
Evaluation object 20	0.884	30.607	0.972	11
Evaluation object 118	1.699	30.275	0.947	12
Evaluation object 8	1.71	29.427	0.945	13
Evaluation object 199	1.793	29.172	0.942	14
Evaluation object 162	1.879	30.286	0.942	15
Evaluation object 200	1.941	29.137	0.938	16
Evaluation object 204	2.594	28.953	0.918	17
Evaluation object 211	3.081	27.725	0.9	18
Evaluation object 152	3.418	28.847	0.894	19
Evaluation object 134	3.626	29.285	0.89	20

Note: Limited to space, only the top 20 results in relative proximity are listed.

Based on entropy weight The TOPSIS method can be used to obtain the positive ideal of all the evaluation objects' acceptance evaluation on the integration of digital technology into foreign language teaching in colleges and universities. Solution distance S+, distance of negative ideal solution S-, relative proximity Z, and sorting results are shown in Table 3. According to the results, there are 6 evaluation objects with serial numbers 154, 130, 126, 86, 65, 43, and 23, respectively. They fully accept the integration of digital technology

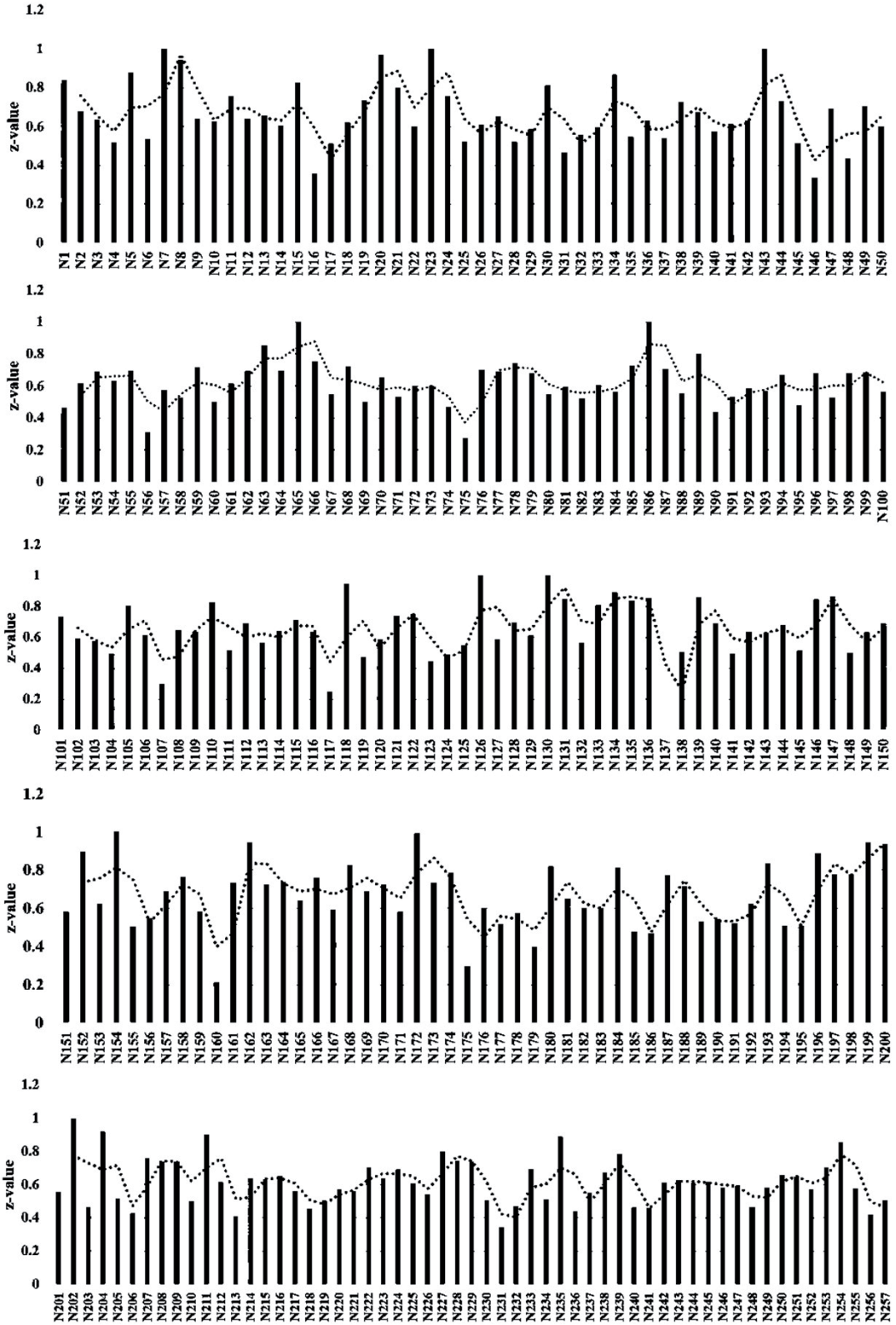

Fig. 3. Relative proximity results of 257 evaluation objects.

into college foreign language teaching mode, accounting for 2.33% of the total sample. Its corresponding positive ideal solution distance S+ is 0, and the distance of the negative ideal solution S- were all 30.86. The Z value of the relative proximity of the evaluation object 202 is 0.996, ranking 9th; the positive ideal solution distance S+ and the distance of the negative ideal solution S- were 0.12 and 30.76, respectively. The Z value of the relative proximity of the evaluation object 134 is 0.89, ranking 20th; positive ideal solution distance S+ and the distance of the negative ideal solution S-were 3.626 and 29.285, respectively. The Z value of the 1st and 20th places is 0.11. This shows that different evaluation objects accept the integration of digital technology into foreign language teaching in colleges and universities' degree performance. There is a big difference.

Fig. 3 shows the score results of the relative proximity Z value of all 257 evaluation objects on the acceptance of digital technology into foreign language teaching in colleges and universities. It can be seen from the figure that the scores of different evaluation objects differ greatly, which further verifies the previous conclusion.

Results of Factors Influencing the Acceptance of Digital Technology in Foreign Language Teaching

In order to further explore the influencing factors of the evaluation object's acceptance of digital technology's integration into foreign language teaching in colleges and universities, based on the methods of literature review and expert consultation, we selected "L1 information accuracy score", "L2 privacy protection score", "L3 lack of imagination score", "L4 dependence score", "L5 strengthen education gap score", and "L6 human-computer interaction score" as independent variables, and the relative proximity Z value of the acceptance of digital technology's integration into foreign language teaching in colleges and universities as the dependent variable, and used the multiple linear regression model to test.

Table 4 shows the regression analysis results of the overall data of the sample. From the estimate, the results showed that the two factors of "L4 dependence score" and "L5 strengthening education gap score" were significant at the level of 1%, and the corresponding P values were 0.003 and 0.002, respectively; "L3 lack of imagination score" and "L6 human-computer interaction score" were significant at the level of 5%, and the corresponding P values were 0.024 and 0.011, respectively. This shows that the dependence on digital technology, imagination, educational equity, and interpersonal interaction problems have the greatest impact on the degree of docking. The influence of other factors is not significant.

Further, in order to test the stability of the results, the regression models with gender as grouping were constructed by grouping regression. See Table 5 for regression results. The results showed that the sample size of the male group was 185, and the test results showed that the two variables of "L4 dependence score" and "L5 education gap score" had a significant level of 1%; in the female group, only the "L6 human-computer interaction score" has 5% significance for the dependent variable. There were significant differences in regression analysis between male and female groups. Therefore, it can be considered that the evaluation objects of different genders accept the integration of digital technology into foreign language teaching in colleges and universities. The degree has this conclusion is consistent with previous studies.

Table 4. Overall regression results.

	Whole				
	B	Standard error	*T*	*P*	*β*
Constant	3.983	3.936	1.012	0.313	-
L1 information accuracy score	0.068	0.067	1.001	0.318	0.066
L2 privacy score	0.123	0.066	1.87	0.063	0.118
L3 lack of imagination score	0.132*	0.058	2.272	0.024	0.142
L4 dependence score	0.202**	0.068	2.979	0.003	0.195
L5 education gap score	0.194**	0.061	3.176	0.002	0.186
L6 human computer interaction score	0.199*	0.078	2.564	0.011	0.184
sample size	257				
R^2	0.522				
Adjust R^2	0.51				
F value	*F* (6250) = 45.422, p = 0.000				

Note: "*" means significant at 1% level, "**" means significant at 5% level

Table 5. Grouping regression results.

	Male					Female				
	B	Standard error	*T*	*P*	*β*	*B*	Standard error	*T*	*P*	*β*
Constant	3.319	4.287	0.774	0.44	-	10.549	9.37	1.126	0.264	-
L1 information accuracy score	0.047	0.082	0.571	0.569	0.046	0.124	0.128	0.972	0.335	0.125
L2 privacy score	0.122	0.082	1.494	0.137	0.117	0.158	0.122	1.297	0.199	0.158
L3 lack of imagination score	0.08	0.071	1.117	0.266	0.084	0.113	0.116	0.977	0.332	0.128
L4 dependence score	0.276**	0.078	3.554	0	0.27	0.052	0.139	0.372	0.711	0.049
L5 education gap score	0.273**	0.073	3.749	0	0.263	0.016	0.13	0.127	0.899	0.016
L6 human computer interaction score	0.14	0.09	1.558	0.121	0.128	0.320*	0.157	2.039	0.046	0.303
Sample size	185					72				
R^2	0.585					0.358				
Adjust R^2	0.571					0.298				
F value	*F* (6178) = 41.807, p = 0.000					*F*(6,65) = 6.034, p = 0.000				
* p<0.05 ** p<0.01										

Note: "*" means significant at 1% level, "*" means significant at 5% level

Conclusions

In the era of digitalization and intelligence, AI technology represented by digital technology has had an impact on traditional college foreign language teaching. It is possible to integrate digital technology into college foreign language teaching. This paper focuses on the integration of digital technology into the acceptance evaluation of foreign language teaching in colleges and universities and explores the frontier of this issue. The acceptance evaluation index system is constructed based on the Delphi method, where the select entropy weight TOPSIS model was used to evaluate acceptability. Finally, the main factors affecting the acceptability were tested by overall and grouping regression models. The main conclusions are as follows:

(1) Based on the Delphi method, we can construct five teaching models, including "teaching mode, teaching skills, teaching ideas, teaching content, and teaching effect for dimension acceptance using the degree evaluation index system. This paper selects several experiences. A rich number of teaching experts conducted surveys and formed the evaluation index system of digital technology integrated into college foreign language teaching through multiple rounds of consultation.

(2) Based on entropy weight, the TOPSIS model found that the Z value of the relative proximity of the acceptance of digital technology into college foreign language teaching has significant heterogeneity. From the positive ideal of the evaluation object, the solution distance S+ and the distance of the negative ideal solution shows that the S-value has a huge difference. At the same time, the scores of 257 evaluation objects on the relative proximity Z value of the acceptance of digital technology into foreign language teaching in colleges and universities are quite different, which further verifies this conclusion.

(3) Through multiple linear regression analysis, it can be found that the evaluation object's concerns about digital technology's dependence, imagination, educational equity, and interpersonal interaction have the greatest impact on its acceptance. Through the overall regression analysis, it was found that these four factors passed the significance test of 5% level. Finally, the grouping regression results show that gender factors will lead to the heterogeneity of acceptance.

The above research conclusions have important reference value for the reform of foreign language education and teaching in colleges and universities. The scientific and rational use of AI tools such as digital technology will become an important direction of intelligent teaching.

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Conflict of Interest

The authors declare no conflict of interest.

References

1. YANG Z.K., WANG J., WU D. The impact of ChatGPT/ generative AI on education and coping strategies. Journal of East China Normal University, Education Science Edition. **41** (7), 26, **2023**.
2. LI H.C. ChatGPT's wisdom generation characteristics and challenges to higher education. Jiangsu Higher Education. **8**, 1, **2023**.
3. ZOU K.L., LIU Z.B. ChatGPT's ethical risks and China's coping institutional arrangements. Journal of Hainan University, Humanities and Social Sciences Edition. **41** (4), 74, **2023**.
4. STEPANOV V., MADZHUMDER M.S., Begunova D.D. Exploring the potential of applying the artistic intelligence language model ChatGPT-3.5 in Library and bibliographic activities. Scientific and Technical information processing. **50** (3), 166, **2023**.
5. WANG Z.L., WU Y.J., WANG Y. ChatGPT and educational reform -- how to transform education in the intelligent age. Journal of Distance Education. **41** (4), 27, **2023**.
6. LUO F., MA Y.X. The impact of AI generated content on academic ecology and Countermeasures – Based on ChatGPT discussion and analysis. Modern Educational Technology. **33** (6), 15, **2023**.
7. HU S.Y., GUO Z. N., LIU J. From knowledge learning to thinking training, educational reform in the ChatGPT era. Journal of Soochow University (Education Science Edition). **11** (3), 63, **2023**.
8. MA R.Z., LIANG Y. The triple logic of the digital transformation of international Chinese Education -- from ChatGPT. Journal of Henan University (Social Sciences Edition). **63** (5), 112, **2023**.
9. NIU L., WANG X.L. Research on the training mode of machinetranslation post editing ability in the ChatGPT era. Foreign language audio visual teaching. **4**, 16, **2023**.
10. DAI L., HU J., ZHU Z.T. ChatGPT's new strategy for enabling digital transformation of education. Open Education Research. **29** (4), 41, **2023**.
11. ZHOU H.Y., CHANG S.L. The future prospect, potential risks and governance of generative artificial intelligence embedded in higher education. Modern Education Management. 1, **2023**.
12. YAN L.L., HOU H.Y. ChatGPT's moral sense and the technical limit of moral education in higher education. China's Audio Visual Education. (11), 72, **2023**.
13. DAI X., GUO L.J. ChatGPT's intervention mode, risk and coping strategies in higher education. Higher Education Exploration. **5**, 12, **2023**.
14. WEI H., ZHENG Y.H., CHEN J. Challenges and opportunities of ChatGPT for business. Foreign Economics and Management. **45** (9), 69, **2023**.
15. ZHANG J.W. ChatGPT's educational thinking, The educational challenges and ethical limits of different relational techniques. Research on Audio Visual Education. **44** (9), 5, **2023**.
16. BI W.X. The challenge and response of generative artificial intelligence to the education industry -- Taking ChatGPT as the analysis object. Jiangsu Higher Education. **8**, 13, **2023**.
17. ZHANG Z.H., JI Y., NIU S.J. The internal mechanism, characterization and risk resolution of ChatGPT embedded in education ecology. Modern distance education. (4), 3, **2023**.
18. FENG Y.G., QU L. The ethical risk of ChatGPT applied to education and its prevention and control. Inner Mongolia Social Sciences. **44** (4), 34, **2023**.
19. ZHANG C.L., WANG Y.Z. Construction of evaluation index system for students' mathematical innovation quality – Investigation and analysis based on Delphi method. Educational Science Research. 7, 6, **2021**.
20. YU Q.F., CHEN J.Y., SONG J. Delphi survey on the construction of teachers' home school cooperative literacy indicators. Research on Teacher Education. **34** (6), 9, **2022**.
21. TIAN X.J., BAO X.Z., YANG D.F. Based on entropy weight-Research on the core technology identification of TOPSIS Delphi method – Taking chip industry technology as an example. Journal of Information. **41** (8), 7, **2022**.
22. SHE Q.Y., OUANG Y.L. Construction of the evaluation index system for the achievement degree of the goal of the integration of industry and Education -- a study based on Delphi method and analytic hierarchy process. Exploration of Higher Education. (12), 104, **2021.**
23. SHI C.Y., HAN P.P., ZHANG M.L. Quantitative evaluation and empirical research on adolescent physical health promotion policy based on PMC index model. Sports and Science. **43** (6), 13, **2022**.
24. MU J., MAO Y.P., ZHANG L., QI Q. Construction of evaluation index system for hospital infection prevention and control ability of nursing staff based on Delphi method. Chinese Journal of infection control. **21** (12), 1229, **2022**.
25. WANG M.T., YE C.M. Based on entropy weight Evaluation of regional industrial green manufacturing level based on TOPSIS. Science and Technology Management Research. **40** (17), 8, **2020**.
26. XU J.Z., SUN Y., SUN X.G. Based on entropy weight Topsis-pso-elm green innovation capability evaluation model and empirical research of manufacturing enterprises. Operations Research and Management. **29** (1), 10, **2020**.
27. KE W.K., WANG J. Based on entropy weight Evaluation of urban higher education resources carrying capacity based on TOPSIS model. Statistics and Decision Making. **18**, 4, **2020**.
28. WEI Y.H., WANG B.S., ZHU L. Based on Spatiotemporal entropy weight Measurement of high quality economic development level based on TOPSIS evaluation method – a case study of Guangdong Province. Statistics and Decision Making. **8**, 91, **2023**.
29. YUAN S.L. Multiple linear regression analysis of the impact of enterprise logistics costs on enterprise benefits. Statistics and Decision Making. **4**, 3, **2019**.