ISSN 2522-6398 Vol. 7, Issue 1: 94-101, DOI: 10.25236/FER.2024.070113

Analysis of Factors Influencing Online Teaching Ability of Secondary School Teachers

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Abstract: *Online education has become an integral component of our daily routines. Accurately understanding the factors that affect the online teaching ability of secondary school teachers can contribute to enhancing their online instructional performance. This research conducted a survey on the current situation of online teaching ability of teachers in a secondary school in Chengdu. A combination model of entropy weight method and factor analysis method was used to calculate the weight of factors related to teachers' online teaching ability, and an Importance-Performance Analysis (IPA) quadrant diagram was drawn to analyze each ability factor. The results indicated that teachers excelled in nine abilities, including homework supervision, online teaching plan design, and multimedia resource application etc. It is crucial to maintain these strengths going forward. However, there were issues in two abilities, such as the integration of online lesson preparation resources and hardware operation, which required high attention. Finally, four strategies were proposed to enhance teachers' online teaching ability. By doing so, it contributes to a deeper understanding of the key factors influencing online instruction among educators. The research offers several theoretical contributions and practical implications for refining teachers' competencies in online teaching.*

Keywords: *Secondary school teachers; Online teaching ability; Influencing factors; factor analysis*

1. Introduction

Recently, China has attached great importance to improving the online teaching ability of teachers. The Implementation Plan for Accelerating the Modernization of Education (2018-2022) pointed out that it is essential to promote the deep integration of information technology and education teaching, and gradually achieve full coverage of information technology teaching and learning applications for teachers and students. The depth of integration between those two aspects is not enough, and there is still a shortage of high-end research and practical talents. We need to vigorously cultivate the information literacy of teachers. "Modernization of Education in China 2035" pointed out that it is significant to use information technology to promote teaching reform, indicating that online teaching ability is a key ability that teachers must have in the information age. The effectiveness of online teaching is lower than that of offline teaching, with nearly half of the teachers believing that the effectiveness of online teaching is only 40% -60% of that of offline teaching[1]. The technical knowledge of teachers has positive impacts on teaching effectiveness, and cultivating their online teaching ability has become a core issue in the current construction of the teaching staff. This paper takes a secondary school in Chengdu as an example and uses a combination of factor analysis and entropy weighting method to calculate the weight of various ability factors in teacher online teaching. Then, an IPA quadrant diagram was drawn for analysis. Finally, based on the analysis results, feasible measures are proposed to enhance the teachers' online teaching ability.

2. Selection of Factors Influencing the Online Teaching Ability of Secondary School Teachers

In the research on the division of teacher's online teaching ability, Xu and Sun constructed a spiral loop teacher's online teaching ability model, which includes seven dimensions: platform resource integration ability, online teaching tool application ability and so on[2]. Chen and others analyzed the new

ISSN 2522-6398 Vol. 7, Issue 1: 94-101, DOI: 10.25236/FER.2024.070113

ability structure of teachers in the new era, including modern educational concepts, ability to systematic teaching design, teaching monitoring, information literacy, and lifelong learning ability[3]. Tang, Zhou and Ren used Chengdu Normal University as an example to study the current status of teachers' online teaching ability using a questionnaire, and constructed a training model about this, including the cultivation of online knowledge, online teaching design, and the ability to connect online teaching with offline teaching[4]. Xiong and Min conducted a study on the development mechanism of online teaching ability among American university teachers. They attach great importance to the development of teachers online teaching ability, including ability to teaching design and carefully organize courses, apply advanced technology, strengthen interaction, and make reasonable evaluations[5]. Sui conducted an empirical study on the influencing factors of information technology teaching ability among university teachers, and constructed a hypothetical model of the influencing factors of it, including self-efficacy, computer experience, and sustained intention to use information technology teaching[6]. Liu constructed a framework model for the online teaching ability of open university teachers based on practical knowledge, including their educational and teaching abilities, information technology abilities, and humanistic care abilities[7]. Evidently, both online and offline teaching require teachers to possess the most basic teaching abilities. Online teaching is different from offline teaching, and teachers need to have the ability to collect, organize, and apply online teaching resources for lesson preparation and teaching. And the teaching evaluation ability of homework supervision and learning assessment is particularly important.

In alignment with the four principles of scientificity, accessibility, independence, and universality as outlined in the construction of the index system[8], this paper selects the factors influencing the online teaching ability of secondary school teachers from four distinct dimensions. Finally, 18 factors are included (Table 1).

Table 1: Factors influencing the online teaching ability of secondary school teachers

Dimension	***Ability influencing factors***
Basic Competence in Online Teaching	Hardware operation ability
	Software operation ability
	Multimedia resource application ability
	online platform utilization ability
	Self-improvement learning ability
Preparation Competence in Online Teaching	online teaching plan design ability
	online lesson preparation resource integration ability
	Teaching planning ability
	Home-school communication ability
Teaching Competence in Online Teaching	Student situation monitoring ability
	Classroom interaction ability
	Questing and answering ability
	Teaching tool utilization ability
	Classroom mobilization ability
	Classroom discipline control ability
	Hierarchical teaching ability
Evaluation Competence in Online Teaching	Homework supervision ability
	Learning assessment ability

3. Research Methods and Design

3.1. Research methodology

Common methods for calculating indicator weights include factor analysis, entropy weight method, grey correlation analysis, neural online models, etc. By adopting the method of combining weights, more indicator information can be obtained and the reliability of weight calculation can be improved. Whether different weight calculation models can be combined mainly depends on whether the solution results of different models are consistent. If the solution results are consistent, it indicates that the model can be combined. This paper intends to use factor analysis model and entropy weight method to calculate the weight of teachers' online teaching ability. The specific steps are as follows:

Step 1: Under the i-th factor, the contribution of the j-th teacher a_{ij}:

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$$a_{ij} = \frac{x_{ij}}{\sum_{j=1}^{n} x_{ij}} \tag{1}$$

Step 2: Determine the weights of each factor:

$$v_i = \frac{(1-e_i)}{\sum_{i=1}^{n}(1-e_i)} \tag{2}$$

Where e_i is the entropy value of the i-th indicator:

$$e_i = -\frac{1}{\ln n}\sum_{j=1}^{n} a_{ij} \ln a_{ij} \tag{3}$$

Step 3: Seeking combinations to solve for weights:[9]

$$w_i = \frac{\sqrt{u_i v_i}}{\sum_{i=1}^{m}\sqrt{u_i v_i}} (i = 1, 2, 3, \cdots, n) \tag{4}$$

Among them, u_i is the weight calculation result of factor analysis, v_i is the weight calculation result of entropy method, and w_i is the final combined weight calculation result.

3.2. Questionnaire design and distribution

To understand the situation of online teaching ability of secondary school teachers, this paper designs a questionnaire on the influencing factors of this, which includes two main contents: the basic part and the formal questionnaire. The basic part mainly involves six aspects such as teacher gender, age, professional title, and teaching time. The formal questionnaire is a 5-point Likert scale, in which participants answer strongly disagree (1) to strongly agree (5). The higher the score, the better the teacher's mastery of this ability. Finally, a questionnaire was distributed to the school teachers through the Question Star platform, and a total of 276 valid questionnaires were collected for subsequent data analysis.

3.3. Reliability and validity test of questionnaire

The study used SPSS 26.0 for data analysis, and found that the overall Cronbach Alpha coefficient of the scale was 0.979 and the reliability of the sub scales was greater than 0.9, indicating that the reliability of the scale is high. Validity reflects the degree to a measuring tool can accurately measure the features it try to measure. The results showed that KMO=0.964 (>0.9), indicating a strong correlation between various factors, making it very suitable for factor analysis. The approximate chi square value of Bartlett's spherical test is 6644.318, and the probability value is Sig.=0.000(<0.05) when the degree of freedom (df) is 153, rejecting the null hypothesis, indicating a significant correlation between the variables. So, the scale has good reliability and validity and can be used for factor analysis.

4. Data analysis and results

4.1. Basic information statistics

The study used SPSS 26.0 to statistically analyze the basic information of the questionnaire. From the perspective of gender distribution, the proportion of female teachers is 50% and male teachers is 50%; From the perspective of age distribution, the proportion of teachers aged 20-30 is 4.7%, teachers aged 30-40 is 38.8%, and teachers aged 40 and above is 56.5%; From the distribution of professional titles in secondary school, the proportion of second level teachers is 29.7%, first level teachers is 37.3%, senior teachers is 30.8%, and senior high school teachers is 2.2%; From the perspective of teaching time, the proportion of teachers with less than 2 years of teaching experience is 2.5%, teachers with 2-5 years of teaching experience is 0.4%, teachers with 5-10 years of teaching experience is 10.9%, and teachers with 10 years or more of teaching experience is 86.2%.

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4.2. Calculation of weights for teachers' online teaching abilities

The study employed Principal Component Analysis (PCA) and orthogonal rotation, with the criterion of variance contribution rate exceeding 86%, to extract four primary factors. Its characteristic roots are 13.337, 1.319, 0.566, and 0.374. The variance contribution rates of the four common factors after rotation are 31.697%, 28.710%, 13.362%, and 12.868%. To clarify the meanings of the four common factors, this paper rotated the initial factor loading matrix and finally obtained the factor analysis results after orthogonal rotation, as shown in Table 2.

Table 2: Rotating component matrix

Dimension		***Teacher online teaching ability factor***	***Component***			
			1	**2**	**3**	**4**
Teaching Competence in Online Teaching	x_1	Classroom discipline control ability	**0.875**	0.242	0.150	0.125
	x_2	Hierarchical teaching ability	**0.845**	0.253	0.197	0.184
	x_3	Classroom interaction ability	**0.763**	0.312	0.302	0.287
	x_4	Classroom mobilization ability	**0.736**	0.410	0.301	0.239
	x_5	Student situation monitoring ability	**0.727**	0.282	0.315	0.340
	x_6	Questioning and answering ability	**0.706**	0.334	0.413	0.252
	x_7	Teaching tool utilization ability	**0.696**	0.459	0.146	0.310
Basic Competence in Online Teaching	x_8	Multimedia resource application ability	0.328	**0.849**	0.196	0.180
	x_9	Software operation ability	0.272	**0.829**	0.247	0.267
	x_{10}	Hardware operation ability	0.301	**0.764**	0.124	0.317
	x_{11}	Self-improvement learning ability	0.311	**0.761**	0.343	0.279
	x_{12}	online platform utilization ability	0.394	**0.741**	0.403	0.171
	x_{13}	Teaching planning ability	0.445	**0.493**	0.451	0.464
Evaluation Competence in Online Teaching	x_{14}	Learning assessment ability	0.425	0.392	**0.684**	0.319
	x_{15}	Homework supervision ability	0.469	0.427	**0.673**	0.257
Preparation Competence in Online Teaching	x_{16}	online lesson preparation resource integration ability	0.357	0.511	0.202	**0.675**
	x_{17}	Home-school communication ability	0.434	0.407	0.385	**0.606**
	x_{18}	online teaching plan design ability	0.391	0.502	0.405	**0.578**

Based on the variance decomposition common factor extraction results, by normalizing the rotated variance contribution rate, this paper can obtain the weights of teachers' ability to online teaching, basic, evaluation, and lesson preparation as 0.366, 0.331, 0.154, and 0.149, respectively. By calculating the rotated component matrix, the weights of each influencing factor can be obtained. The comprehensive score model is as follows. Among them, the coefficient of weight protection is:

$$Y = 0.219x_1 + 0.243x_2 + 0.298x_3 + 0.312x_4 + 0.302x_5 + 0.313x_6 + 0.308x_7$$
$$+0.362x_8 + 0.382x_9 + 0.353x_{10} + 0.389x_{11} + 0.378x_{12} + 0.392x_{13} + 0.373x_{14}$$
$$+0.370x_{15} + 0.389x_{16} + 0.387x_{17} + 0.408x_{18}$$

After calculating the weights, since the sum of the weights of all indicators is 1, it is necessary to normalize the indicators and obtain the normalized weight data as shown in Table 3.

Table 3: Weight results

Factor	***Coefficient1***	***Coefficient2***	***Coefficient3***	***Coefficient4***	***Weight***	**Normalization**
x_1	0.240	0.211	0.199	0.205	0.219	0.0354
x_2	0.231	0.220	0.262	0.302	0.243	0.0393
x_3	0.209	0.272	0.401	0.470	0.298	0.0483
x_4	0.202	0.357	0.400	0.391	0.312	0.0505
x_5	0.199	0.245	0.419	0.557	0.302	0.0488
x_6	0.193	0.291	0.548	0.412	0.313	0.0507
x_7	0.191	0.400	0.195	0.508	0.308	0.0498
x_8	0.090	0.740	0.260	0.294	0.362	0.0586
x_9	0.075	0.722	0.329	0.436	0.382	0.0619
x_{10}	0.082	0.665	0.164	0.518	0.353	0.0571
x_{11}	0.085	0.663	0.455	0.456	0.389	0.0629
x_{12}	0.108	0.645	0.536	0.281	0.378	0.0611
x_{13}	0.122	0.429	0.599	0.760	0.392	0.0635
x_{14}	0.116	0.341	0.909	0.522	0.373	0.0604
x_{15}	0.128	0.371	0.894	0.420	0.370	0.0600
x_{16}	0.098	0.445	0.268	1.105	0.389	0.0629
x_{17}	0.119	0.354	0.512	0.992	0.387	0.0627
x_{18}	0.107	0.437	0.538	0.946	0.408	0.0660

According to formulas (3-1) to (3-3), the weights of each factor obtained by the entropy weight method are $\{x_1, x_2, x_3, ..., x_{18}\}$={0 0446, 0.0414, 0.0448, 0.0443, 0.0462, 0.0481, 0.0486, 0.0624, 0.0637,

ISSN 2522-6398 Vol. 7, Issue 1: 94-101, DOI: 10.25236/FER.2024.070113

0.0565, 0.0732, 0.0656, 0.0626, 0.0635, 0.0628, 0.0504, 0.0581, 0.0633}. To test whether the weights of teacher's online teaching ability calculated by the factor analysis model and entropy weight method can be combined, this paper uses Kendall synergy coefficient to conduct consistency testing on the combination evaluation. The calculation shows that the Kendall coefficient is 0.621, with a significance P=0.000<0.05. We can combine they for calculation. According to formula (3-4), the final combination weights { $x_1, x_2, x_3,..., x_{18}$} can be calculated as {0.0398, 0.0404, 0.0466, 0.0474, 0.0475, 0.0494, 0.0492, 0.0605, 0.0628, 0.0569, 0.0680, 0.0634, 0.0631, 0.0620, 0.0614, 0.0564, 0.0604, 0.0604, 0.0647}.

4.3. IPA Quadrant Analysis

To delve deeper into the factors that influence teachers' online teaching capability, this paper employs the Importance Performance Analysis (IPA) method. This approach visually assesses teachers' online teaching ability through the quadrant diagrams[10]. This paper maps the IPA quadrant of teachers' proficiency in online teaching competencies by employing the average score of each competency's degree of compliance on the vertical axis, with a threshold of 3.956, and the portfolio weights on the horizontal axis, with a threshold of 0.055. The higher the weight value, the more important the ability is. Similarly, the higher the average value, the higher the degree of conformity of the ability. To effectively leverage these weightings, this paper proposes actionable measures tailored for online teaching. The influencing factors are categorized into four regions: advantage region, maintenance region, opportunity region, and improvement region, as shown in Figure 1.

Advantage region: The ability factors located within this quadrant have a high weight and degree of conformity, including 9 ability factors: self-improvement ability, online teaching plan design ability, homework supervision ability, learning assessment ability, teaching planning ability, online platform utilization ability, software operation ability, multimedia resource application ability, and home-school communication ability. It mainly reflects in two aspects: basic ability in online teaching and lesson preparation ability. This indicates that in the actual process of online teaching, teachers proficient in platform operation and function usage, can prepare online courses well with high professional quality and enhance their core competitiveness in conducting online teaching for themselves.

Maintain region: The ability factors located within this quadrant have a low weight but a high degree of conformity, including only one ability factor of questioning and answering ability. Due to the separation of time and space in online teaching, it is difficult to track and control the learning situation of students, and the overall control of the classroom by teachers is poor, which affects the teaching process and effectiveness. Therefore, this teaching method is rarely used in actual teaching processes. However, when conducting questioning and answering, most teachers can effectively guide students to think and provide solutions, which can effectively control teaching discipline and progress.

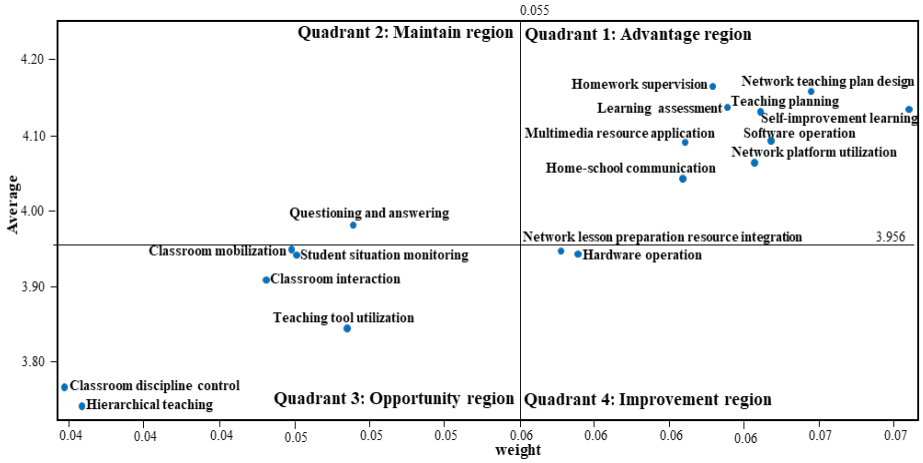

Figure 1: IPA quadrant of factors influencing teachers' online teaching ability

Opportunity region: The ability factors located within this quadrant have a low weight and a low degree of conformity, mainly including teaching tool utilization ability, classroom mobilization ability, student situation monitoring ability, classroom interaction ability, classroom discipline control ability, and hierarchical teaching ability. For the surveyed teachers, these abilities are considered unimportant and the performance of teachers in these aspects is also not ideal. Although ability to classroom mobilization, student situation monitoring, and classroom interaction are in the opportunity region, their

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importance and compliance are relatively close to the maintenance region, indicating that as teachers become proficient in using online platforms, they will gradually focus some of their energy on student supervision, interaction with students, and improve classroom quality. In the future, these three ability factors may become important abilities affecting teachers' online teaching.

Improvement region: The weight value of the ability factors located within this quadrant is high, but the degree of conformity is low, including two ability factors: hardware operation ability and online lesson preparation resource integration ability. This indicates that the teacher's emphasis and cultivation of these abilities are not satisfactory, which some extent restricts the effectiveness of online teaching. Most teachers lack experience in dealing with hardware issues such as device noise and online disconnections, and are unable to promptly and effectively handle similar emergencies in online teaching. Moreover, during lesson preparation, most teachers tend to neglect the organization and effective application of online teaching resources. In future online teaching practices, emphasis should be placed on enhancing teachers' sense of identification with online teaching and their own information literacy, with a focus on improving and cultivating their hardware operation and resource integration abilities.

5. Discussion

Through a comparative analysis of the influencing factors of online teaching in those four regions, the study found that it performs better in self-improvement ability, online teaching plan design ability, and home school communication ability and so on. However, there is a significant gap in the integration of hardware operation skills and online lesson preparation resources for teachers. Therefore, based on the weight data of factors affecting teaching ability and literature materials, strategies and suggestions for optimizing teacher online teaching are proposed from a theoretical level, as follows:

5.1. Update concepts and enhance recognition of online teaching

With the rapid development of Internet technology, all aspects and processes of teaching are closely connected to it. Only by improving the level of onlineed and information-based teaching of teachers can the effectiveness of online teaching be improved. The survey results show that there are certain problems in their ability to use teaching tools, classroom mobilization, and hierarchical teaching and so on. Moreover, their enthusiasm and initiative in learning theoretical knowledge related to online teaching are not high. The reason is that teachers lack sufficient understanding of online teaching, experience in computer hardware operation, and identification with online teaching. Zhou proposed that in the information technology era, teachers can start by transforming their teaching methods and roles[11]. Enable teachers to explore and apply common computer technology, information technology, and modern educational technology from similarity in appearance to actively integrating classroom teaching applications, ultimately achieving the goal of independent exploration and application.

5.2. Establish an assessment mechanism to ensure the effectiveness of online teaching for teachers

The survey results show that hardware operation ability and online lesson preparation resource integration ability are in the improvement region, indicating that these ability factors significantly affect the effectiveness of online teaching. Jia think when teachers face online failures, they should fully utilize their educational wit to control teaching content, upload teaching materials and lesson preparation resources in advance[12]. Meanwhile, the relevant management departments of the school can introduce systematic and implementable routine management measures for it, such as providing teachers with online operation training, collecting online lesson preparation resources, etc, incorporating them into teacher teaching assessments in accordance with the school's relevant management system.

5.3. Take measures to implement the new curriculum reform concept

It is more difficult for teachers to implement personalized teaching and carry out adaptive teaching in online teaching. Research has found that among the influencing factors of abilities, teachers' ability to use teaching tools, classroom mobilization, student situation monitoring, and hierarchical teaching appear in the scope of opportunity region. To address the mismatch between these abilities, this paper proposes the following three measures. Firstly, reduce classroom content, refine classroom objectives, and arrange teaching progress reasonably. Compared to conventional teaching, online teaching is subject to more interference factors. To ensure the new curriculum reform concept is reflected in online teaching, only in this way can multiple factors be taken into account. Secondly, fully leverage the role of online

ISSN 2522-6398 Vol. 7, Issue 1: 94-101, DOI: 10.25236/FER.2024.070113

teaching platforms and information technology tools. Zou and others proposed that online teaching can be carried out through different forms of online teaching modes, effectively addressing various online teaching problems while improving students' effective learning and differentiated cultivation[13]. Thirdly, regularly organize and carry out teaching and research activities. In the digital education era, teachers need to adapt to various new teaching methods rapidly. It can be seen that online teaching need the support and assistance of the teaching team.

5.4. Promote home school cooperation and jointly promote student learning

Due to the spatial separation between teachers and students in online teaching, it is difficult for teachers to control the learning situation of students in real time. Additionally, the development of cognitive and psychological factors among secondary school students is not stable, especially the self-control ability of the lower is still poor. Therefore, parents should cooperate with teachers to supervise students' online learning, providing students with a smooth online software environment and good online learning hardware equipment. Similarly, teachers should keep in touch with parents timely, pay attention to the learning status and physical and mental development process of students, modify lesson plans and teaching outlines timely, and adjust their teaching methods reasonably.

6. Conclusion

The rapid development of information technology requires teachers to continuously improve their online teaching abilities. This research revealed that the hardware operation ability and the online lesson preparation resource integration ability in the improvement region have a greater impact on teachers' capability to teach effectively online. Nevertheless, teachers' competency in these two areas is relatively low. Consequently, this issue warrants high attention. Furthermore, 9 abilities, including homework supervision, learning assessment etc., are located in the advantage region. This indicates that teachers have performed well in this domain and can continue to sustain and enhance their performance. Although some achievements have been made in our study, there are still several issues needed to be addressed. Firstly, continue to enrich the content of the influencing factor system of teachers' teaching ability and enhance its scalability in application. Secondly, explore more quantitative models to enhance the reliability of quantitative results, such as correlation analysis, neural online models, multiple regression analysis, etc. The third is to expand the scope of data collection, making the research results more generalizable and persuasive.

Acknowledgements

This paper is the research result of the school-level project of Yibin University in 2021, "Research on Education Technology Ability Cultivation of Rural Primary School Teachers under the Background of Smart Education -- taking Yibin City of Sichuan Province as an example" (Number: 62).

References

[1] Wu, D.-G., & Li, W. The phased characteristics of large-scale online teaching in Chinese universities: an empirical study based on a questionnaire survey of students, teachers, and academic administrators [J]. Journal of East China Normal University, 2020, 38 (07), 1-30.
[2] Xu, P., & Sun, Y. Construction and improvement path of a teacher's online teaching ability model based on online course quality standards [J]. China Electronic Education, 2022 (06), 89-95.
[3] Chen, L., Li M., & Chen, Q. On the new ability structure of teachers in the internet era [J]. China Electronic Education, 2003 (04), 65-68.
[4] Tang, C., Zhou, X.-Y., & Ren, Y.-H. Construction and reflection on school-based training model for information technology teaching ability of primary and secondary school teachers [J]. Training for Primary and Secondary School Teachers, 2019 (01), 20-22.
[5] Xiong, H.-J., & Min, L. Development mechanism and inspiration of online teaching ability of American college teachers [J]. China Electronic Education, 2014 (10), 112-117+128.
[6] Sui, X.-H., Zhao, G.-D., Wang, J.-X., & Zhang, Y.-X. Empirical study on the factors influencing the informatization teaching ability of college teachers: A case study of some universities in Hunan province [J]. China Electronic Education, 2020 (05), 128-134.
[7] Liu, N., & Liu, Y.-Q. Construction of a teacher's online education ability model from the perspective

ISSN 2522-6398 Vol. 7, Issue 1: 94-101, DOI: 10.25236/FER.2024.070113

of practical knowledge [J]. China Distance Education, 2021 (08), 40-50.
[8] Shao, Y.-F. Research on the quality evaluation index system of online teaching of public physical education courses in universities [D]. Fuyang Normal University, 2021.
[9] Wang, C.-X., Xu, J.-Y., Guo, L., & Zheng, Q.-H. Research on the evaluation framework of multi-scene man-machine collaborative online teaching —— Based on hierarchical analysis method and entropy weight method [J]. Modern Educational Technology, 2023,33 (01), 74-82.
[10] Zhao, X.-R. Evaluation of tourism attraction of Xingwen world geopark based on IPA [D]. Chengdu University of Technology, 2020.
[11] Zhou, B.-R. Teacher professional growth in the era of big data [J]. Digital Education, 2020,6 (05), 1-8.
[12] Jia, H.-X. Teaching problems and response methods encountered during the epidemic [J]. Chinese Journal of Multimedia and Online Teaching (Mid term), 2020 (04): 240-241.
[13] Zou, W., Cao, L., & Wan, K. The current situation, differences, and reflection on online teaching of different nature courses from the perspective of student experience[J]. Digital Education, 2021,7 (06), 31-38.