

Research on the ability of online teaching construction in Colleges and Universities Based on Maturity Model under the "COVID-19"

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ABSTRACT. *The outbreak of the "COVID-19" epidemic accelerated the progress of online teaching construction in Colleges and universities. However, from the perspective of the current situation, the online teaching construction capacity of colleges and universities is uneven. How to achieve the improvement of its capacity, an objective evaluation of the online teaching construction capacity of colleges and universities is the key. Based on the literature research and the summary of online teaching practice in Colleges and universities, this study abstracts the connotation of online teaching construction capacity in Colleges and universities, and analyzes the characteristics of each level of online teaching construction capacity maturity in Colleges and Universities Based on the 10 dimensions of connotation; on this basis, it constructs the model index system of online teaching construction capacity maturity in Colleges and universities, and constructs the online teaching construction capacity maturity in Colleges and universities from the 10 dimensions of connotation The cobweb model of the maturity of teaching construction ability. The construction of the maturity model of online teaching construction capacity in Colleges and universities is helpful to comprehensively evaluate the online teaching construction capacity in Colleges and universities, and then promote its gradual improvement.*

KEYWORDS: *COVID-19, colleges and universities, Online teaching, Maturity cobweb model*

1. Introduction

The "COVID-19" epidemic accelerated the development of online teaching in Colleges and universities, and online teaching has become the inevitable choice of

many colleges and universities when there is still a greater risk of transmission of the epidemic. In addition to the differences between online and offline learning methods, online teaching and traditional teaching put forward new requirements for teaching hardware, software and overall and coordinated educational administration management, and challenges teachers' curriculum design, teaching process arrangement, implementation and evaluation and students' learning ability. Colleges and universities should regard it not only as a challenge of teaching organization and management, but also as an important opportunity of current traditional teaching reform.

Online education teaching and classroom organization form, inevitably requires the reform of classroom teaching and talent training, and also requires the corresponding innovation of teaching management system in Colleges and universities. At the system level, the standard level and the operation level, it is necessary to ensure that the operation of each link of online teaching has evidence, so as to adapt to and promote the new needs of online teaching reform.

For teachers, online teaching is not a simple virtualization and networking of offline teaching, but a reconstruction of the whole teaching process based on online resources, tools, platforms, knowledge transfer characteristics of online learning, in-depth analysis of the media use, information needs and learning preferences of college students, and systematic design of online teaching process and activities. Teachers can also give full play to the main role of quality assurance of grass-roots teaching organizations and carry out "regular cloud meetings and collective lesson preparation" through the opening of technical consultation and exchange platform.

Students themselves also need to carry out self-study of network resources before class, listen to classes with problems, take seriously what they don't understand, and see how the teacher analyzes it. In the course of interactive discussion, review the key knowledge after class, and achieve the effect of twice the result with half the effort. Meanwhile, actively participate in the online and offline hybrid learning such as question answering of difficult questions test and extended reading after class.

Based on this, novel coronavirus pneumonia evaluation system is provided in this study. On the one hand, it can provide short-term thinking for online teaching with the influence of new crown pneumonia. It also provides some long-term suggestions for the development of educational informatization, hoping to enlighten the University's online education.

2. The connotation of online teaching capacity building

Through the analysis of the existing literature, it is not difficult to find that online teaching in Colleges and universities has accumulated some research results. According to Yang changju (2020), with the change of teaching methods, the school education and teaching management mechanism should be adjusted accordingly in time, forming a vertical three-level management system of "school preparation group teacher" from top to bottom [1]. Hu Xiaoping and Xie Zuoshi (2020) based on

the online teaching quality report of 57 universities in China and the statistical report of curriculum platform data of Fujian and Shandong provinces, analyzed the practice status of online teaching in Colleges and universities from the use of online teaching platform, the situation of teachers' teaching, the situation of students' learning, the data of online teaching management, etc. [2]. Li Kehan and Liu Yao (2020) take the online teaching mode of West China College of Stomatology of Sichuan University as an example to explore and build a new online teaching mode of "learning as the center", including gradually selecting appropriate online teaching platform, advocating and improving students' ability of independent learning, timely evaluating the effect of online teaching and infiltrating humanistic care into online teaching [3].

From the existing literature, in the research field of online teaching in Colleges and universities, most of them will involve the three stakeholders of schools, teachers and students. However, there are not many researches on the construction ability of online teaching in Colleges and universities, and the definition of the connotation of the construction ability of online teaching in Colleges and universities is not clear enough.

This study will start from the three stakeholders, school, teachers and students, sort out the key elements of stakeholders, and clarify the connotation of online teaching construction capacity in Colleges and universities. Specifically speaking, at the school level, in order to promote the construction of online teaching, we can start from three aspects, including online teaching hardware, online teaching software and online teaching overall coordination management; at the teacher level, in order to adapt to online teaching, we can consider from four aspects, including online course design, online teaching process arrangement, online teaching implementation and online teaching evaluation. At the student level, in order to adapt to online learning, we can start from three aspects, including online learning needs, online learning tools and online learning ability.

Therefore, this study covers 10 dimensions (as shown in Figure 1) when defining the connotation of online teaching construction capacity in Colleges and universities.

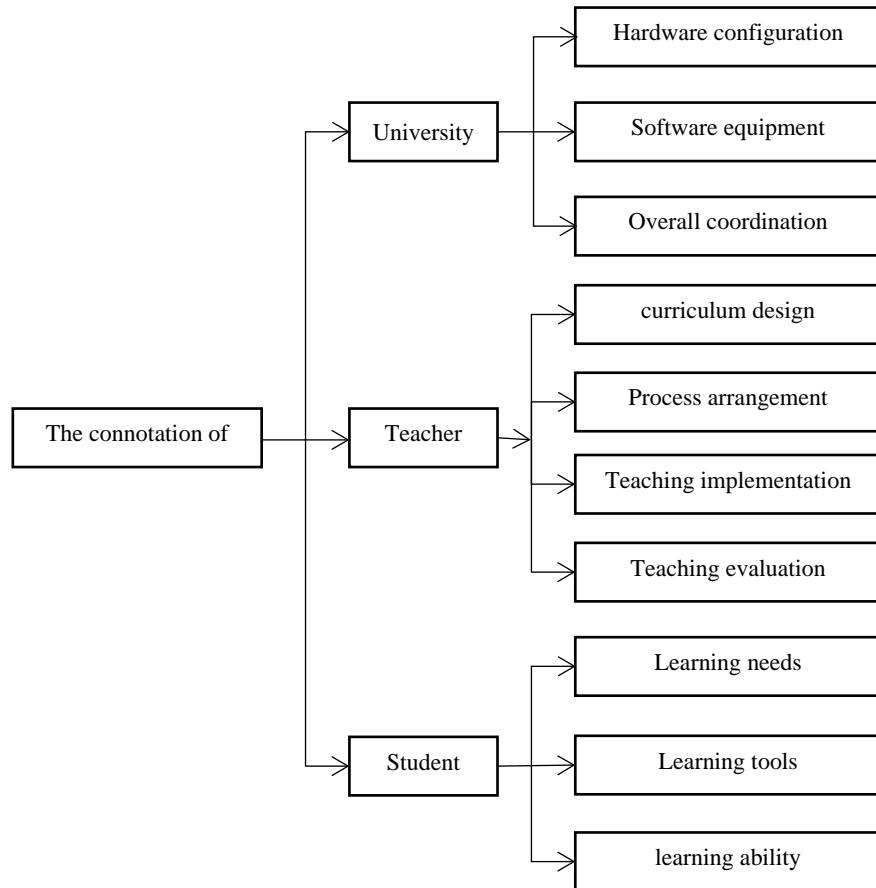


Figure. 1 The connotation of online teaching capacity building

3. On-line teaching capacity maturity level characteristics

According to the general theory of capability maturity model, capability maturity can be divided into five levels: initial level, repeatable level, defined level, manageable level and optimization level. The maturity model of online teaching capacity is no exception. In order to better evaluate the maturity level of online teaching construction in Colleges and universities, it is necessary to define the scope and boundary of different maturity levels, that is, to define the maturity standard of each indicator in the indicator layer. In the online teaching construction capacity of colleges and universities, the maturity is divided into five levels, among which, level 1 corresponds to the initial level, level 2 corresponds to the repeatable level, level 3 corresponds to the defined level, level 4 corresponds to the manageable level, and level 5 corresponds to the optimized level.

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Table 1 Maturity standard of relevant dimensions at school level

Related parties	Evaluation dimension(Online)	Maturity criteria
University (A)	Hardware configuration(A ₁)	Level 1: equipped with basic hardware equipment but imperfect management
		Level 2: equipped with basic hardware and complete management
		Level 3: replacement of new and old basic hardware
		Level 4: equipped with high-end hardware equipment but the management needs to be improved
		Level 5: equipped with high-end hardware and complete management
	Software equipment(A ₂)	Level 1: lack of curriculum resources and unstable platform operation
		Level 2: sufficient curriculum resources and stable platform operation
		Level 3: the quality of online teaching teachers is not high
		Level 4: abundant curriculum resources and teachers reserve
		Level 5: flexible use of curriculum resources and network platform
	Overall management(A ₃)	Level 1: in chaos, no collaboration
		Level 2: initially establish communication channels
		Level 3: establish relevant systems of overall planning and coordination management
		Level 4: free communication, clear responsibilities, mutual assistance
		Level 5: promote online teaching quality through overall planning and coordination

Table 2 Maturity standard of relevant dimensions at the teacher level

Related parties	Evaluation dimension(Online)	Maturity criteria
Teacher (B)	curriculum design(B ₁)	Level 1: unclear audience and course content
		Level 2: the audience is not clear, the course content is clear but the delivery is inefficient
		Level 3: clear audience, clear course content and effective delivery
		Level 4: clear audience, complete and accurate course content transmission
		Level 5: show the course content to the right audience in the right way
	Teaching process(B ₂)	Level 1: the process arrangement is disordered and does not meet the needs
		Level 2: disordered process arrangement, but some of them meet the needs
		Level 3: process arrangement is reasonable but does not meet the needs
		Level 4: process arrangement is reasonable and partially meets the needs
		Level 5: the process arrangement is reasonable and fully meets the needs
	Teaching implementation(B ₃)	Level 1: unreasonable use of resources and inappropriate teaching methods
		Level 2: unreasonable use of resources but appropriate teaching methods
		Level 3: reasonable use of resources but inappropriate teaching methods
		Level 4: reasonable use of resources but appropriate teaching methods
		Level 5: reasonable use of resources and appropriate teaching methods
	Teaching evaluation(B ₄)	Level 1: online teaching is not evaluated
		Level 2: evaluation of some online teaching, not institutionalized
		Level 3: online teaching evaluation system established
		Level 4: flexible use of online teaching assessment
		Level 5: improve online teaching quality with online teaching evaluation

Tabel 3 Maturity standard of relevant dimensions at the student level

Related parties	Evaluation dimension(Online)	Maturity criteria
Student (C)	Learning needs(C1)	Level 1: there is no demand for itself and no requirement for the school
		Level 2: they have occasional needs, but they are not required by the school
		Level 3: self demand but not required by the school
		Level 4: self demand and school encouragement
		Level 5: own needs and school requirements
	Learning tools(C2)	Level 1: lack of hardware and software tools
		Level 2: basic hardware tools and software tools
		Level 3: complete hardware tools and software tools
		Level 4: able to actively play the role of tools to a certain extent
		Level 5: flexible use of various hardware tools and software tools
	learning ability(C3)	Level 1: lack of self-study ability and self-discipline ability
		Level 2: have certain self-study ability but lack of self-discipline ability
		Level 3: have certain self-study ability and self-discipline ability
		Level 4: strong ability of self-study and self-discipline
		Level 5: be able to reasonably arrange the time, draw inferences from one instance

4. Maturity model of online teaching capacity building

4.1 Construction ideas

The outbreak of The "COVID-19" epidemic accelerated the construction progress of online teaching in Colleges and universities, but from the current situation of construction, the online teaching construction capacity of various colleges and universities is uneven. Therefore, through the construction of the maturity model of online teaching construction capacity in Colleges and universities, it is helpful to evaluate the online teaching construction capacity in Colleges and universities comprehensively and objectively, identify the short board of capacity

construction, and improve pertinence, so as to promote the overall improvement of online teaching construction capacity in Colleges and universities.

The capability maturity model considers that capability upgrading is a gradual process. The construction of the maturity model of online teaching construction capacity in Colleges and universities aims to comprehensively evaluate the online teaching construction capacity in Colleges and universities and promote its gradual improvement. By combing the stakeholders of online construction capacity in Colleges and universities, summarizing and refining the key elements of stakeholders, that is, the connotation of online teaching construction capacity in Colleges and universities (including 10 dimensions), constructing the maturity model index system of online teaching construction capacity in Colleges and universities, and finally forming the maturity cobweb model of online teaching construction capacity in Colleges and universities. The specific construction ideas are as follows.

The first step, according to the connotation of online teaching construction capacity in Colleges and universities, combined with the actual activities of online teaching in Colleges and universities, initially select indicators; then, combined with expert opinions, remove unimportant factors, merge duplicate indicators, and build the maturity model index system of online teaching construction capacity in Colleges and universities.

The second step is to use the analytic hierarchy process (AHP) to give weight to the index system of the model, and to define the weight of the evaluation index of the maturity model of online teaching construction in Colleges and universities.

The third step, according to the maturity model index system of online teaching in Colleges and universities, from 10 dimensions, such as online teaching hardware and online teaching software, constructs the maturity cobweb model of online teaching in Colleges and universities.

4.2 Determination of maturity model evaluation index

The research on online teaching related literature in Colleges and universities is relatively small, and there is not a relatively mature evaluation index in the evaluation of online teaching construction capacity in Colleges and universities. In order to ensure the scientificity and objectivity of the evaluation indicators, on the basis of literature review, combined with the relevant activities carried out by various colleges and universities to implement online teaching under The "COVID-19" epidemic situation, combined with expert opinions, eliminated unimportant factors, combined with repeated indicators, summarized the evaluation indicator system of Online teaching construction capacity maturity model of colleges and universities as shown in Table 1. (involving 10 dimension levels, 33 indicators in total)

Table 4 Evaluation index system of Capability Maturity Model of online teaching construction

Related parties	Evaluation dimension	Index level	
University (A)	Teaching hardware(A ₁)	Infrastructure network construction(A ₁₁)	
		Construction of live broadcast / recording room for video / audio(A ₁₂)	
		Construction of online teaching network platform(A ₁₃)	
		Construction of virtual simulation experiment teaching sharing platform(A ₁₄)	
	Teaching software(A ₂)	Online teaching teacher training(A ₂₁)	
		Online teaching assistant(A ₂₂)	
		Establishment of network technical support group(A ₂₃)	
		Online course resources(A ₂₄)	
	Teaching coordination management (A ₃)	Educational administration management(A ₃₁)	
		Teacher management(A ₃₂)	
		Student management(A ₃₃)	
		Network management(A ₃₄)	
Teacher(B)	curriculum design(B ₁)	The definition of teaching objectives and objects(B ₁₁)	
		Course content design(B ₁₂)	
		Course presentation design(B ₁₃)	
		Curriculum evaluation standard design(B ₁₄)	
	Process arrangement(B ₂)	Pre class tutorial(B ₂₁)	
		Classroom interaction(B ₂₂)	
		Answer questions after class(B ₂₃)	
		Test and assessment(B ₂₄)	
	Teaching implementation(B ₃)	The choice of teaching resources(B ₃₁)	
		Selection of online teaching methods(B ₃₂)	
	Teaching evaluation(B ₄)	Student satisfaction assessment(B ₄₁)	
		Online teaching quality assessment(B ₄₂)	
		Continuous improvement capability assessment(B ₄₃)	
		School assessment and evaluation requirements(C ₁₁)	
	Student(C)	Online learning needs(C ₁)	Self learning demand driven(C ₁₂)
			Online learning hardware tools(C ₂₁)
Online learning tools(C ₂)		Online learning software tools(C ₂₂)	
		The ability to study independently(C ₃₁)	
Online learning ability(C ₃)		Self discipline(C ₃₂)	
		Time management capability(C ₃₃)	
		Knowledge transfer ability(C ₃₄)	

4.3 Index weight determination

When evaluating maturity model, it generally includes both qualitative and quantitative evaluation. The construction of maturity model index system reflects the qualitative relationship between elements, while the quantitative relationship is reflected by the weighting of index system. Therefore, after the establishment of the maturity model evaluation index system of online teaching construction capacity in Colleges and universities, it is necessary to determine the weight of maturity model evaluation index.

When determining the evaluation index weight of the maturity model of online teaching construction in Colleges and universities, the AHP method is used to assign the weight to the relevant level, dimension level and index level. The first step is to establish a hierarchical structure model, and define the relevant level as the first level index, which includes the school (a), the teacher (b) and the student (c); the dimension level is defined as the second level index, which includes the online teaching hardware (A1), the online teaching software (A2) and other 10 dimensions; the indicator level is defined as the third level index, which includes the infrastructure network construction (a11), video / audio live / recording room (A12), etc. The second step is to invite experts to make a comparison between the two indexes and judge the importance of the indexes, and use the proportion scale of nine quantiles (as shown in Table 5) to score. In the third step, the judgment matrix is constructed according to the expert score, and the consistency test and weight are determined according to the eigenvalues and eigenvectors of the judgment matrix. Taking the determination of the first level index weight as an example, this paper explains in detail how to use the analytic hierarchy process to determine the index system.

Table 5 The scale of the nineties

Importance	A	B	C	D	E	F	G	H	I
Scale	9	7	5	3	1	1/3	1/5	1/7	1/9

We define A as more important than B, and so on.
 $A > B > C > D > E > F > G > H > I$.

Note: the importance of 8 is between 7 and 9. Similarly, 2, 4 and 6 are the intermediate judgment values of adjacent scales.

(1) Constructing judgment matrix

According to the scores of experts and the scale table, a judgment matrix of pairwise comparison is obtained $D = (d_{ij})_{n \times n}$.

Judgment matrix $D = (d_{ij})_{n \times n}$ An orthogonal matrix satisfies the following attributes simultaneously:

$$d_{ij} = d_i / d_j \quad (1)$$

$$d_{ij} = 1 \quad (i=j) \quad (2)$$

$$d_{ij} = \frac{1}{d_{ji}} \quad (3)$$

In this study, according to the experts' scores on the first level indicators, the following judgment matrix is constructed.

$$D_1 = \begin{bmatrix} 1 & 3 & 5 \\ 1/3 & 1 & 3 \\ 1/5 & 1/3 & 1 \end{bmatrix} \quad (4)$$

(2) Calculation of weight

Will judge the matrix D_1 each row of vectors is geometrically averaged, i.e. each row is multiplied by each valueParalleland cubic.

$$W = \sqrt[3]{\prod_{j=1}^3 d_{ij}} \quad (5)$$

$$W_1 = \sqrt[3]{1 \times 3 \times 5} = 2.466 \quad (6)$$

$$W_2 = \sqrt[3]{\frac{1}{3} \times 1 \times 3} = 1 \quad (7)$$

$$W_3 = \sqrt[3]{\frac{1}{5} \times \frac{1}{3} \times 3} = 0.405 \quad (8)$$

To weight vector $W = (W_1, W_2, W_3)$ Normalization, get the weight of the first level index, $W_1 = 0.64, W_2 = 0.26, W_3 = 0.10$.

(3) Consistency test

AHP involves a lot of subjective judgment, which needs to be integrated into some objective evaluation, so it needs to test the consistency of the judgment matrix. In general, use CI or CR, as an index to check the consistency of judgment matrix. When $n \geq 2$, consistency ratio of judgment matrix $CR = \frac{CI}{RI} < 0.1$. That is to say, the judgment matrix passes the consistency test. If it fails to pass the consistency test, it is necessary to reconstruct the judgment matrix.

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (9)$$

$$CR = \frac{CI}{RI} \quad (10)$$

λ_{\max} The approximate value of the largest eigenvalue of the judgment matrix, RI Average randomness index (as shown in table6).

Table 6 Average randomness index

Order number	1	2	3	4	5	6	7	8	9
RI	0	0	0.52	0.9	1.12	1.26	1.36	1.41	1.49

The consistency test of the above judgment matrix shows that:

$$\lambda_{\max} = 3.032 \quad (11)$$

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (12)$$

$$CR = \frac{CI}{RI} = 0.0308 < 1 \quad (13)$$

Therefore, it passes the consistency test. That is, the weights of the first level indicators are: $W_1 = 0.64, W_2 = 0.26, W_3 = 0.10$.

According to the above methods and steps, the judgment matrix is constructed for the dimension layer and the indicator layer respectively, and the consistency test is carried out to get the qualified weight (Table 7).

4.4 The construction of cobweb model of teaching capacity maturity

According to the construction idea of the maturity model of online teaching construction capacity in Colleges and universities, after the index system and weight of the model are determined, a spider web model of the maturity of online teaching construction capacity in Colleges and universities covering 10 dimensions such as online teaching hardware configuration and online teaching software configuration is established on this basis (as shown in Figure 2). On the one hand, the construction of maturity cobweb model is helpful for colleges and universities to analyze the advantages and disadvantages of their own online teaching construction capacity, improve targeted, and comprehensively enhance the online teaching construction capacity; on the other hand, it is convenient to compare the maturity of different colleges and universities' online teaching construction capacity.

First, according to the weight of 33 indicators and expert scores of the indicator layer, after weighting and summing up, the scores of 10 dimensions of the dimension layer are calculated; then, according to the scores, the position of each dimension in the spider web model is determined, and the current situation of each dimension of the online teaching construction capacity of colleges and universities is evaluated; finally, the sequential connection is made Based on the scoring position of each dimension in the cobweb model, an irregular area of decagonal shape is obtained, that is, the overall situation of the maturity of online teaching construction capacity in Colleges and universities.

Through the analysis of Figure 2, it is not difficult to see that the maturity levels of online teaching construction capacity maturity model in Colleges and universities

show the relationship between inclusion and inclusion, and the higher the level, the wider the scope. The low-level online teaching construction ability of colleges and universities lays the foundation for the follow-up high-level, and the promotion of the maturity level of online teaching construction ability of colleges and universities is a step-by-step process.

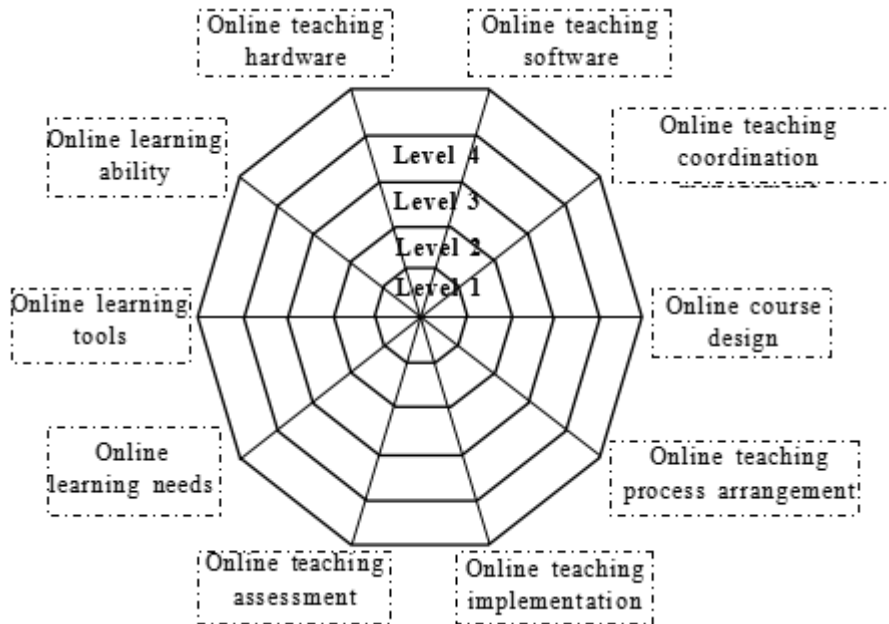


Figure.2 Cobweb model of capacity maturity of online teaching construction

5. Conclusion

Online teaching in universities is the inevitable product of Internet plus education. The outbreak of The "COVID-19" disease has accelerated its construction progress. Based on the existing literature research, this study summarizes and abstracts the connotation of online teaching construction capacity in Colleges and universities; the internal online teaching hardware is equipped with online teaching software is equipped with online teaching overall coordination management online course design online teaching process arrangement online teaching implementation online teaching assessment online learning needs online learning tools online learning ability initial level management level defined level predictable level Level optimization and level analysis are carried out to build the maturity model index system of online teaching construction capacity in Colleges and universities, and the AHP method is used to empower; finally, the spider web model of online teaching construction capacity maturity in Colleges and universities is formed to

comprehensively and objectively show the status of online teaching capacity construction in Colleges and universities.

With the deepening of online teaching practice in Colleges and universities, combined with the online teaching practice in Colleges and universities, the construction of the maturity index system of online teaching construction capacity in Colleges and universities can be further improved, so as to achieve a more objective evaluation of the maturity of online teaching construction in Colleges and universities.

References

- [1] Yang changju. "Vertical and horizontal" management: online teaching implementation strategy [J]. Education Science Forum, 2020 (11): 24-25.
- [2] Hu Xiaoping, Xie Zuoshi. Analysis of the advantages and challenges of online teaching in Colleges and Universities under the epidemic situation [J]. China higher education research, 2020 (04): 18-22.
- [3] Li Kehan, Liu Yao, Xie Jianxu, Wang Yi, Zhang Linglin, Novel coronavirus pneumonia novel coronavirus pneumonia teaching mode on the lower line of Ron. [J/OL]. China Medical Education Technology: 1-3.
- [4] Wu Da Guang. Retrospect and Reflection on the evolution of Educational Technology: Based on the perspective of online teaching in the context of the new outbreak of pneumonia in China, [J]. higher education research in China. 2020 (04): 1-6.
- [5] Zhang Hongwei. Online teaching can be the home of cultivating independent learning ability [n]. China Teachers' daily, 2020 (04).
- [6] Zhang duanhong. Online teaching is a long-term teaching revolution [n]. China Science Daily, 2020 (05).
- [7] Liu Xiaohui, Zhu Jun, Nie Xin. Preliminary study on the maturity model of MOOC curriculum construction management [J]. Value engineering, 2020, 39 (03): 184-187.
- [8] Chen Chao, Xing Xue, Li Dapeng. Research on the maturity of emergency management ability of scientific research projects [J]. Think tank era, 2019 (36): 289-290.
- [9] Zhang Xuemin. Research on the maturity of enterprise human resource management ability [D]. Qingdao University of science and technology, 2016.
- [10] Wang Liran, Zhou Wenwen, Wen Zongchuan. Research on the maturity model of enterprise innovation methods [J]. Research on science and technology management, 2013 (24): 196-198.

Table 7 Index weight

Stake-holder layer	Single weight	Dimension layer	Single weight	Comprehensive weight	Index layer	Monolayer weight	Comprehensive weight
University (A)	0.64	Online teaching hardware (A ₁)	0.70	0.448	Infrastructure network construction(A ₁₁)	0.65	0.289
					Live video / audio studio(A ₁₂)	0.16	0.072
					Online teaching network platform(A ₁₃)	0.10	0.045
					Virtual simulation experiment teaching sharing platform(A ₁₄)	0.09	0.040
		Online teaching software (A ₂)	0.22	0.141	Online teaching teacher training(A ₂₁)	0.53	0.075
					Online teaching assistant(A ₂₂)	0.05	0.007
					Network technical support group(A ₂₃)	0.23	0.032
					Online course resources(A ₂₄)	0.19	0.027
		Online teaching coordination management (A ₃)	0.08	0.051	Educational administration management(A ₃₁)	0.39	0.020
					Teacher management(A ₃₂)	0.29	0.015
Student management(A ₃₃)	0.10				0.005		
Network management(A ₃₄)	0.22				0.011		
Teacher(B)	0.26	Online course design (B ₁)	0.63	0.164	Clear teaching objectives and objects(B ₁₁)	0.63	0.103
					Course content design(B ₁₂)	0.24	0.039
					Course presentation design(B ₁₃)	0.09	0.015
					Curriculum evaluation standard design(B ₁₄)	0.04	0.007
		Online teaching process arrangement (B ₂)	0.14	0.036	Pre class tutorial(B ₂₁)	0.35	0.013
					Classroom interaction(B ₂₂)	0.36	0.013
					Answer questions after class(B ₂₃)	0.13	0.005
					Test and assessment(B ₂₄)	0.16	0.006
		Online teaching implementation (B ₃)	0.19	0.050	The choice of teaching resources(B ₃₁)	0.60	0.030
					Selection of online teaching methods(B ₃₂)	0.40	0.020
		Online teaching assessment (B ₄)	0.04	0.011	Student satisfaction assessment(B ₄₁)	0.29	0.003
					Online teaching quality assessment(B ₄₂)	0.57	0.006
Continuous improvement capability assessment(B ₄₃)	0.14				0.002		
Student(C)	0.10	Online learning needs(C ₁)	0.55	0.055	School assessment and evaluation requirements(C ₁₁)	0.80	0.044
					Self learning demand driven(C ₁₂)	0.20	0.011

	Online learning tools(C ₂)	0.29	0.029	Online learning hardware tools(C ₂₁)	0.62	0.018
				Online learning software tools(C ₂₂)	0.38	0.011
	Online learning ability(C ₃)	0.16	0.016	Self study ability(C ₃₁)	0.50	0.008
				Self discipline(C ₃₂)	0.30	0.005
				Time management ability(C ₃₃)	0.13	0.002
				Knowledge transfer ability(C ₃₄)	0.07	0.001