

# The Study of Quality Evaluation Model for the Real-Time Interactive Online Teaching

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**Abstract**—The massive-scale real-time interactive online teaching that emerged during the COVID-19 pandemic is more intangible and interactive than traditional recording and broadcasting teaching and flipped class, whose quality is more difficult to measure. At present, the epidemic around the world is not optimistic, and universities worldwide are still in the online teaching mode. Constructing a scientific multi-dimensional teaching quality evaluation system is the key to ensuring the quality of real-time interactive teaching in institutions of higher education, and mixed teaching in the post-epidemic era. This study introduces the SERVQUAL service quality measurement method, with students as the majority of evaluation, aiming to construct a real-time interactive online teaching quality evaluation model in universities. This method consists of five dimensions—Tangibles, Reliability, Responsiveness, Assurance and Empathy. Based on this model, this study conducted data analysis on the online teaching quality of universities under the epidemic situation, pointed out the content of service quality that needs to be improved in online teaching, and put forward countermeasures and suggestions for improvement.

**Keywords**—Interactive Teaching, Online Teaching, Quality Evaluation, SERVQUAL

## I. INTRODUCTION

The COVID-19 pandemic has caused a number of significant challenges to the higher education sector. The Ministry of Education has successively issued a number of instructions and notifications since February 2020. Universities worldwide have been forced to rapidly transition to online teaching during this epidemic. While COVID-19 imposes potentially the longer-term impacts, universities have relied on their resources and online platforms to promote online teaching actively. At the beginning of online teaching, multiple methods coexisted, such as "MOOC Teaching", "Recording Teaching", "Live Broadcasting Teaching", etc. From the actual online teaching situation, the mainstream mode of online teaching is to teach through video conferencing software, such as Tencent Meeting and Zoom. Online courses have integrated various video resources of MOOCs. Students could use the functions of interactive platforms such as the "chat" function, sending bullet comments, screen sharing, collaborative documents, question voting, hands raising, to discuss and participate in class.

With the gradual stabilization of the domestic epidemic, online teaching has been implemented steadily. The online teaching method during the COVID-19 is significantly different from traditional online teaching because of its wide range of subjects, massive scale of students and strong interaction between teachers and students. Therefore, it's a new teaching method called massive-scale real-time interactive online teaching. Although it is a product of special conditions in a special period, this method has become a historically significant innovation in the development of online teaching in universities. Simultaneously, it's a milestone for promoting the integration of online and offline higher education in the future. This new teaching method in comparison to traditional teaching has more intangibility and heterogeneity in teacher-student interactions, learning feedback, and academic assessment, etc. Hence, there are difficulties in measuring the quality of online teaching with inconsistency [1]. Many academics have adopted student questionnaire surveys to evaluate quality of online teaching. Universities have arranged teaching quality supervision groups to listen to class for teaching quality evaluation. Foreign universities have also taken corresponding measures to transfer to foreign universities. It is very important to objectively evaluate the teaching quality, and effectively transform formal education into high-quality online education in the covid-19 pandemic [2-4]. However, this evaluation method is from a single dimension with subjective problems. Critical for universities and students is to ensure the quality of real-time interactive teaching and mixed teaching in the post epidemic era.

Many academics have been paid attention to the design and implementation of this interactive teaching method. Cheng Xuejiao et al [5] took a specific course as an example to study the influence of teachers' appearance on the teaching effect in the live broadcast mode. Cao Mei et al [6] studied the influencing factors of online homework on students' learning experience. Few studies focuses on the quality evaluation of online teaching method. Huang Lu et al [7] have studied the teaching quality evaluation from the design of course content system. Du Jing et al [8] have discussed the high concerns in the process of online education. Li Shuang et al [9] have studied the quality framework and core elements of online courses. These are mainly concerned with MOOCs and traditional live broadcasting rather than the current massive-scale real-time interactive online teaching.

In summary, this paper constructs a multi-dimensional real-time interactive online teaching quality evaluation model, aiming at enriching the relevant theories of online teaching quality evaluation in universities. This study will analyze the current situation of real-time interactive online teaching in universities, and provide suggestions for improving the quality of interactive online teaching.

## II. APPLICATION OF SERVQUAL EVALUATION MODEL IN EDUCATION

SERVQUAL (Service Quality), proposed by A. Parasuraman and others in 1988, is a service quality evaluation tool based on the gap between customer perception and expectations and is widely used in the service industry[10]. Education has typical service characteristics such as intangibility, high participation of educators, heterogeneity of teaching effects of different educators, and being difficult to standardize. Therefore, the SERVQUAL model has also been widely used in teaching quality evaluation in the education field.

Foreign scholars have used SERVQUAL model to measure and study service quality of courses through empirical analysis [11-12]. It finds that the differences between students' expectation and perception have an impact on their willingness to continue learning. Gu Jiafeng [13] took Peking University as an example to obtain six dimensions of higher education service quality evaluation through empirical research. Zeng Xiongjun [14] modified the indicators and constructed a SERVQUAL model of teaching service quality based on actual teaching scenarios, and analyzed the service gap in the education process with corresponding countermeasures and suggestions. Zhang Shuang et al [15] constructed a gap analysis model and proposed a new technical method based on fuzzy model to evaluate the service quality of higher education. Zhou Zhengsong et al [16] designed education service quality evaluation models for graduate students to analyze the service quality indicators that universities need to improve. Based on SERVQUAL model, the researches of teaching services quality in universities found that different grades have different quality evaluation results, especially in responsiveness and empathy [17-18]. Zheng Jianmin [19] took an example of a distance open education course to analyze service gaps in class, and proposed specific improvement measures. The above studies show that the SERVQUAL model can be used for teaching quality evaluation, but these previous studies mainly focused on offline teaching and relying on online teaching, especially real-time interactive online teaching.

## III. THE SERVQUAL MODEL OF ONLINE TEACHING QUALITY

This study constructs the SERVQUAL model of online teaching quality from five dimensions--Tangibles, Reliability, Responsiveness, Assurance and Empathy. The index system has been revised by expert interviews based on the characteristics of real-time interactive online teaching. Model includes 22 second-level indicators, as shown in Table I.

Each second-level indicator contains two scores--expectation score for online education  $E_i$ , and perceived online education service score  $P_i$ . The service quality

difference value  $P_i - E_i$  of this quality model SERVQUAL is equal to the perceived score minus the expectation score. This score measures the gap between students' perceptions and expectations. If the score is negative, it means that the actual perception has not exceeded the expectation. Vice versa.

TABLE I. THE STATEMENTS OF REAL-TIME INTERACTIVE ONLINE TEACHING SERVQUAL MODEL

SERVQUAL Dimensions	SERVQUAL Statements	
	Index	Items
Tangibles (A)	A1	Online teaching has complete functional partitions.
	A2	The course content is rich and clear.
	A3	The voice is clear and decent.
	A4	The teaching resources are complete and beautiful.
Reliability (B)	B1	The course information is accurate and reliable.
	B2	The teacher answers students' questions online very seriously.
	B3	The teaching platform is stable and filed.
	B4	Online teaching plan is clear.
	B5	Teaching information and learning records are kept.
Responsiveness (C)	C1	Students get prompt responses to online questions.
	C2	Teachers take the initiative to help students.
	C3	Timely release of teaching resources and information.
	C4	Feedback students' needs in a timely manner.
Assurance (D)	D1	The teacher is trustworthy.
	D2	The teacher has sufficient professional ability.
	D3	The teaching platform is professional.
	D4	The school supports online teaching on software and hardware.
Empathy (E)	E1	The teacher can provide assistance to students' individual needs.
	E2	The teacher adjusts the teaching plan according to students' acceptance ability.
	E3	Schools and teachers understand the needs of students.
	E4	Provide support for those students with network access difficulties.
	E5	Design teaching links according to the characteristics of students' online learning.

## IV. DATA ANALYSIS AND RESULTS

### A. Reliability and Validity Test

According to Table I and the Likert five-level scale method, the questionnaire of this study was designed for students' expectations and perceptions of real-time interactive online teaching services. The questionnaire collected a total of 103

valid questionnaires, including 71 questionnaires for full-time students and 32 questionnaires for part-time students.

The reliability of the survey items in measuring the intended attribute was determined using Cronbach's alpha. All questionnaire items of five SERVQUAL dimensions loaded at acceptable levels (Cronbach's alpha > 0.90). Acceptable composite reliability values 0.991, suggesting no further need for refinement. Therefore, the reliability of this questionnaire is acceptable.

The KMO value of this questionnaire is 0.923, and the cumulative contribution rate is 72.392%. The corresponding relationship between the questionnaire items is basically consistent with the research psychological expectations. In addition, the expected value of the evaluation model is tested, and the cumulative contribution rate is 80.844%, consistent with the conceived expectations.

### B. Gap Analysis

The average level of the overall expectation and perception of the SERVQUAL model is between 4.0 and 4.5 as shown in Table II. The results shows that the quality of real-time interactive online teaching services is generally acceptable at a relatively high level. In terms of Assurance (D), the average value of student perception is closer to the expected average. The Tangibles (A) statement A1 has received a positive evaluation, suggesting that teachers and schools have made sufficient preparations to ensure the development of real-time interactive online teaching. That the perception of Empathy (E) statement E1 is higher than expectation indicates that teachers played a greater role and were able to provide timely assistance to students' needs during the online teaching period.

However, the difference value of this evaluation model are basically negative, and only a few items have a positive score. There are many aspects to improve the service quality of real-time interactive online teaching. Most statements' average perception is less than the average expectation. It shows that students are not satisfied enough with online teaching services. Among the items with negative differences, the three most dissatisfied statements are A2, B5, and C3 with values of -0.19, -0.2 and -0.23 respectively. It shows that students believe that the current timeliness of online teaching interaction and the accuracy of information quality need to be strengthened.

There are significant differences in the expectations of full-time and part-time students for various indicators of real-time interactive online teaching, as shown in Figure 1. Part-time students have higher expectations for all items than full-time students. And the reliability statement B1 and the Assurance statement D2 are the two items with the highest expectation of part-time students, which greatly affect the quality of the course. The expectations of full-time students for multiple indicators of the SERVQUAL model remain within the range of [3.9, 4.4]. The item with the lowest expectation is E1 (3.94). It shows that full-time students have relatively lower empathy requirements for real-time interactive online teaching, which may be related to its better learning foundation and stronger self-learning ability.

Full-time and part-time students also have significant differences in the quality evaluation of real-time interactive online teaching under different dimensions. The opposite evaluations under certain indicators is shown in Figure 2. The full-time students have a positive evaluation in the Reliability statement B4, the Assurance statement D4 and the Empathy statement E3. But the evaluation of part-time students is negative. On the contrary, in the Responsiveness statement C1, full-time give negative evaluation, and part-time students give positive evaluation.

TABLE II. THE SERVQUAL MODEL EVALUATION RESULTS—EXPECTATIONS, PERCEPTIONS, AND DIFFERENCES

SERVQUAL dimensions	Second-level Items	Expectations $E_i$	Perceptions $P_i$	Differences $P_i - E_i$
Tangibles(A)	A1	4.17	4.2	0.03
	A2	4.44	4.25	-0.19
	A3	4.38	4.31	-0.07
	A4	4.39	4.26	-0.13
Reliability(B)	B1	4.49	4.33	-0.16
	B2	4.38	4.35	-0.03
	B3	4.3	4.16	-0.14
	B4	4.27	4.27	0
	B5	4.36	4.16	-0.2
Responsiveness (C)	C1	4.29	4.29	0
	C2	4.36	4.28	-0.08
	C3	4.46	4.23	-0.23
	C4	4.34	4.28	-0.06
Assurance(D)	D1	4.39	4.35	-0.04
	D2	4.47	4.43	-0.04
	D3	4.21	4.22	0.01
	D4	4.23	4.22	-0.01
Empathy(E)	E1	4.02	4.18	0.16
	E2	4.3	4.17	-0.13
	E3	4.25	4.25	0
	E4	4.16	4.13	-0.03
	E5	4.28	4.22	-0.06

In summary, part-time students have relatively lower evaluations of teaching quality, especially in terms of reliable teaching plans, software and hardware supports, and communication of individual needs between teachers and students. This may be related to the gap in knowledge structure and the prominent contradiction between work and study. Although full-time students have positive evaluations of some items, they have negative evaluation in the timeliness of response due to their high academic pressure and better study habits.

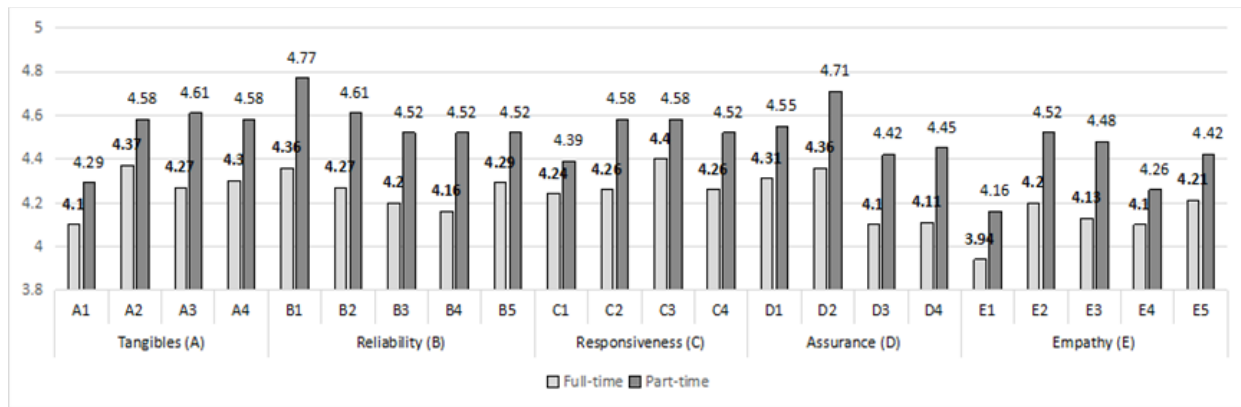


Fig. 1. The expectations of Full-time and Part-time for online teaching

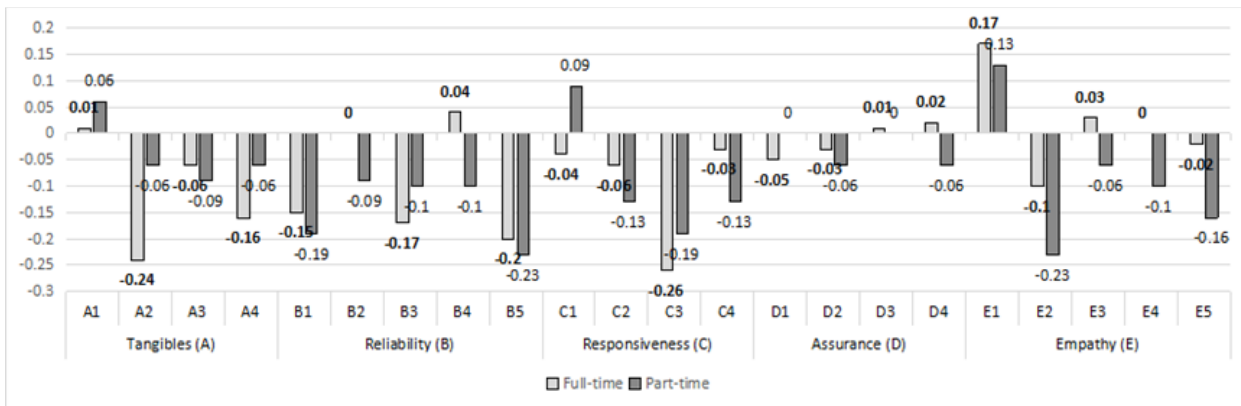


Fig. 2. Online teaching SERVQUAL model evaluation results

## V. CONCLUSION

This paper has provided a new perspective to construct a real-time interactive online teaching quality evaluation model. The empirical analysis based on this model reflects that students' perception of online teaching is generally acceptable under the epidemic of COVID-19. However, online teaching still need to be further improved because the perception of most quality indicators is less than expectation. On the other hand, there are differences between full-time and part-time students in their expectations of certain indicators and evaluation results. Differentiated and targeted improvement measures need to be taken to improve their satisfaction with online teaching.

For full-time students, teachers need to strengthen the tangible display of teaching content, such as presenting the teacher's image in the live broadcast to enhance students' perception of the teaching tangibility. In order to improve timeliness of interaction after class, teaching assistants should be arranged to respond to students' demands and provide relevant help when teachers are focusing on other teaching tasks. Schools and teachers should strengthen management in releasing and recording information in order to meet students' needs in learning and information acquisition and to improve students' satisfaction with online learning.

For part-time students, schools and teachers should strengthen students' individualized teaching assistance and improve mutual communication and software and hardware

support. And they should also regularly publish teaching-related information, actively get to know the difficulties of students' online study and provide timely help and guidance to students.

The model constructed in this paper has high reliability and validity, but still has certain shortcomings. The scope of the questionnaire survey is small. Moreover, the investigation and evaluation should be conducted in universities of other regions to prove the stability of this model.

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