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RESEARCH ARTICLE

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Development of a Causal Model of Factors Affecting Learner Satisfaction with Online Teaching of Primary School Students in Beijing China

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Abstract

This study aims to explore learner satisfaction with the online teaching level of primary school to develop a causal model of learner satisfaction with the online teaching level of primary school students in Beijing, China and validate a model with empirical data. A mixed method of data collection was employed in this study, where the questionnaire was distributed among the primary school learners from the fourth, fifth and sixth grades school students of the total of 752 primary school students were randomly selected to participate in the questionnaires in Beijing, China and five students were selected to participate in the interview. The model was successfully constructed and validated with empirical data showing the measurement model is valid and well fitted to empirical data (x^2=496.262，df=486，p=0.364，GFI=0.946, AGFI=0.938). The results indicated that Learner satisfaction with online teaching level of primary school students in Beijing， China, 3.762, which is close to the satisfaction of learners who "agree" with online teaching.

Keywords: Keywords: Primary school, online teaching, satisfaction, teacher's quality, learning environment, online interaction

INTRODUCTION

During the COVID-19 epidemic, online teaching to primary school students in China was widely promoted to ensure the safety of Chinese students. At the same time, students could accept education and learning knowledge on time as the schooling was "closed not suspended, closed not teaching" under the call of the regional education department. Staff actively carry out online teaching through the radio and television, network, and mobile phone platform in the form of recording or live providing vast amounts of online classes. However, the low satisfaction of primary school students with online teaching causes social issues. In 2021, the Ministry of education and five other departments in China "on strengthening the construction and application of online education teaching resources for primary and secondary schools" (from now on referred to as "opinions"), the "opinions" pointed out the school, teachers, students, parents should make good use of online education teaching, and put forward a variety of directional guidance: to serve better the classroom teaching, service students' autonomous learning. Schools should strengthen students' online independent learning guidance, scientifically set learning tasks and learning objectives, help students to make online learning plans, promote students to develop the habit of independent learning, and improve their ability to independent learning (Jing et al., 2023). We should further strengthen the cooperation between home and school, guide parents to

effectively cooperate with students and guide students to carry out online learning. Enhance the interaction between teachers and students. The school shall organize teachers to interact between teachers and students through the platform or interactive tools, class groups, telephone, video, and face-to-face communication and encourage students to discuss, cooperate, and help students through the class group, study group and study partner. The full adoption of online learning is highly challenging for schools across the country, especially primary schools.

Rosak-Szyrocka et al. (2022) believe that online teaching is a new way of education with many advantages, first; Openness, sharing, and interactivity, one can be unconstrained by many conditions, such as time, space and age; sharing of excellent teaching resources, therefore the advantages of two-way interaction and communication is essential. With the diversity and richness of learning resources and the convenience of resource retrieval, traditional education is incomparable; third, with Flexible and diverse learning styles, the network environment can meet a variety of teaching modes. The main thing is that autonomous learning can be achieved so that learners' initiative, enthusiasm and creativity get full play (Bao & Zheng, 2020).

However, after the development of online teaching encountered many problems, Lu (2021) found a need for teachers' awareness of online teaching. More attention should have been given to improving the teacher's online teaching quality.

Wang et al. (2021) conclude that the encountered problem caused the online teaching during the pandemic are network teaching mode is relatively single, it easy to reduce students' interest in learning, there is less interaction between teachers and students in online teaching, students learning participation enthusiasm to reduce, at the same time, the teacher from the whole process and all-round to urge students to learn. Primary school students have many the same time in physical, psychological, habitual; personalities etc has noticeable differences from the characteristics of college students. Therefore, this study mainly focuses on primary school students to determine their level of satisfaction with online teaching level of primary school students in Beijing, China. The study also aims to develop a causal model of learner satisfaction with the online teaching level of primary school students in Beijing, China, and lastly, model validation with empirical data.

LITERATURE REVIEW

Staker (2011) mentioned that the United States was the first country to study online teaching. In 1996, the United States focused on online teaching. The author believed there were four main learning modes: the rich virtual mode, the self-oriented mode, the circular mode, and the fourth flexible mode. It mentioned that the rich virtual model refers to personalized tutoring to improve the learning process through online teaching. Following the U.S., the U.K. has built a national learning network to connect all schools and institutions. Hu (2006) mentioned that in 2005, the U.K. launched the "e

Strategic Plan" to transform children's learning and service models through informatization. Becta (2011) stated that in 2008, the U.K. launched the "Next Generation Learning Campaign", which targets online education and provides learners with high-quality customized learning resources to meet the needs of learners of different ages.

Zhao and Li (2020) referred to "online teaching" or "distance education", referring to the computer and network technology environment, the use of rich modern teaching resources, through the relevant network platform, to educators and learners to provide a network teaching and learning environment, digital content, teaching and learning process of face-to-face education activities. Wu (2020) believes that online learning should refer to the personalized needs of students, pays full attention to every child, and carries out the online teaching mode of "one class schedule, one teacher for one class".

Bao and Zheng (2020) put forward for primary school students online teaching "ARFG" teaching method, specifically, "A"-assignment, namely by the expert discussion and responsible for customized for pupils home online learning task, directional guidance, "R"-resource, namely provided by teachers rich, personality learning resources, resource accumulation, "F"-feedback, namely by the teacher by phone, WeChat, SMS and another way on one-on-one learning feedback, understand each student problems in the process of online learning. Classify the questions to pave the way for real answering questions. "G"-guide, teachers use online teaching platform to answer questions and tutoring, using online explanations, individual questions, namely video, and online tutoring, so that accurate, personalized help can be provided for each student.

Li (2021) based on a survey of online teaching in 25 primary schools during the epidemic period, the research object was 236 teachers. The survey showed that the selection of online teaching platforms in primary schools was mainly nailed. Statistical results show that 98.73% of teachers use the nail teaching platform, 7.2% chose WeChat, and 0.85% chose Q.Q. In addition, a few teachers (0.85%) use teaching platforms such as Le Education, Sivo Whiteboard and Tencent Classroom. Various teaching platforms teachers select to use have functions such as sign-in, positioning, discussion, testing, classroom monitoring, homework review and so on. Teachers' live teaching also has the function of video playback, which can provide students to review after class and consolidate the knowledge learned in time.

Constructivism Learning Theory

Since the 1990s, Constructivism Learning Theory (CLT) has gradually become popular in the West as an essential branch of the cognitive psychology school (Bada & Olusegun, 2015). Constructivism learning theory emphasizes that students should actively construct new knowledge with their own knowledge as the background. Learning is not a process of teachers imparting knowledge to

students but a process of students actively constructing a knowledge (Jing et al., 2023). In teaching, students do not simply listen to the teacher's lecture but take the initiative to choose and process the knowledge learned (Tangney et al., 2001).

In mixed teaching, educators need to change the traditional educational concepts and give students the initiative to learn. Traditional teaching is mainly based on teachers 'imparting knowledge (Isa et al., 2020). Students passively accept knowledge and then constantly strengthen their memory, which limits the development of students' creative thinking. Teachers give rich resources before class, so students can establish their own knowledge structure according to their learning needs and experience.

Humanitarian Learning Theory

In the 1950s and 1960s, the theory of humanistic learning emerged in the United States, and its main representative figure was Abraham H. Maslow and Carl Ransom Rogers (Sartre et al., 2022). Humanist learning theory attaches great importance to stimulating students 'high-level learning motivation and emphasizes the full development of students' potential and positive self-concept, value and attitude system so that students can give full play to their personality roles. This theory emphasizes teachers' understanding of students' inner psychological world, so as to conform to students' interests, needs, experiences and individual differences, to develop the potential of students and raise their cognitive and emotional functions, and pay attention to the restriction of creativity, cognition, motivation, emotion and other psychological aspects on behavior.

Humanistic psychologists advocate that educational goals should point to students' individual creativity, purpose and significance. Therefore, according to the humanistic learning theory, mixed teaching should first recognize and respect students' personal differences, encourage students to give full play to their advantages and strengths, pay attention to teaching students in accordance with their aptitude, and not restrict students with unified learning results. It encourages students to design their own learning goals and create a free and loose learning environment, thus realizing a personalized education model.

Self-Regulation and Learning Theory

In the 1970s, American psychologist Albert Bandura proposed the concept of a self-regulated learning (Zimmerman et al., 1992). This concept refers to the process in which learners actively regulate their cognition, motivation and behavior to complete the learning tasks and obtain satisfactory learning results successfully. Wang et al. (2019) stated the theory of self-regulation learning had developed different theoretical orientations, including strengthening theoretical orientation, development

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orientation, social cognitive processing orientation, information processing orientation, constructivism orientation, phenomenological orientation, etc.

Interaction Theory

According to Bandura's ternary interaction theory, the influence distance emphasized by the model includes both physical and psychological dimensions. Since the interaction mainly emphasizes physical distance, this may lead to a lack of understanding between teachers and learners (Zhang et al., 2023). Interaction theory analyzes the relationship between learners and teachers. This interactive process focuses on the dialogue between teachers and students and involves the teaching guidance, "scaffolding," and support provided by teachers. The purpose of teaching is to stimulate or maintain students' interest and provide motivation for learning (Zhang et al., 2023).

Customer Satisfaction Theory

Customer satisfaction theory refers to a personal and subjective emotional reflection of consumers to the consumption object and consumption process after consumer products or services, which is the feeling state of pleasure or disappointment formed by consumers' actual perception of the consumption object or consumption process compared with the expected value. Xu (2018) stated that customer satisfaction theory has gradually become an essential theoretical basis for student satisfaction evaluation in the field of education.

In addition, Xu (2018) established a second-order model of perceived quality which subdivided perceived quality into four dimensions: curriculum resources, learning environment, teacher literacy, and teaching interaction. The model was established through data verification. It shows that perceived quality is closely related to curriculum resources, learning environment, teacher literacy and teaching interaction, which is also an essential factor in improving satisfaction. The customer satisfaction model was first used in industry and business but was gradually applied to education. The most current model is the ACSI model, the U.S. Satisfaction Index model. This model is modified from the Swedish Customer Satisfaction Barometer (Sweden Customer Satisfaction Barometer), as shown in Figure 1 and Figure 2.

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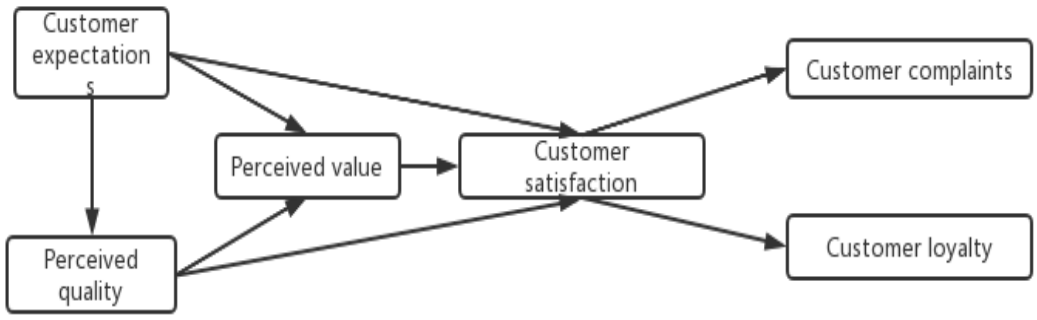

Figure 1: Customer satisfaction index model

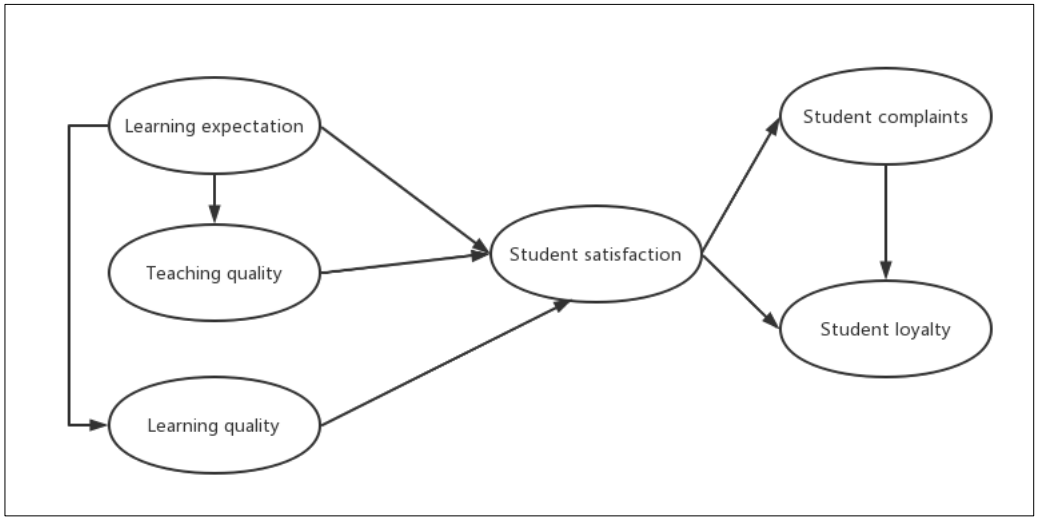

Figure 2: The GCT-CSI student classroom satisfaction model (Xu, 2018)

Xu (2018) stated that students expect a significant positive impact on learning quality. If the quality difference of this expectation is slight and within the range acceptable to the customer, then the perceived quality moves in the desired direction. Second, he believes that students' expectations have a significant positive impact on learner satisfaction. He believes the study of online teaching satisfaction can learn from the cumulative customer satisfaction evaluation model. Thirdly, he believes that perceived quality significantly and positively affects student satisfaction. He believes that many empirical studies show that perceived quality is a pre-factor for customer satisfaction. Customers have a close relationship with their satisfaction in the process of being served. Fourth, student satisfaction directly has a positive impact on student loyalty. He believes that both student complaint and student loyalty are the outcome variables of student satisfaction. The more students complain, the lower the student satisfaction and the lower the natural student loyalty.

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Research Hypothesis

Xu (2018) found that learners will have certain subjective expectations and understanding before receiving online courses, which will significantly positively impact perceived quality. He also found that whether the online learning participants were satisfied would positively impact whether they would continue to choose online learning. In a questionnaire survey of learners on the MOOC platform of Chinese universities, Guo (2016) found that students 'satisfaction was somewhat affected by perceived value, and perceived value had a significant positive impact on students' satisfaction. Hong (2019) found that the perceived quality of online teaching would significantly impact perceived value in rural areas. In the study on the satisfaction of online teaching with the help of the American customer satisfaction model. Zhang (2009) found that perceived quality directly and significantly positively affected learner satisfaction. Based on the literature, the following assumptions are proposed:

H1: learning expectation has a significant positive effect on perceived quality.

H2: learning expectation has a significant positive effect on perceived value.

H3: learning expectation has a significant positive effect on learner satisfaction.

H4: perceived quality has a significant positive effect on learner satisfaction.

H5: perceived quality has a significant positive effect on perceived value.

H6: perceived value has a significant positive effect on learner satisfaction.

H7: learner satisfaction has a significant positive effect on willingness to continue learning.

This study will use the customer satisfaction index model to propose the online teaching satisfaction index model for primary school students and propose a research framework as shown in Figure 3.

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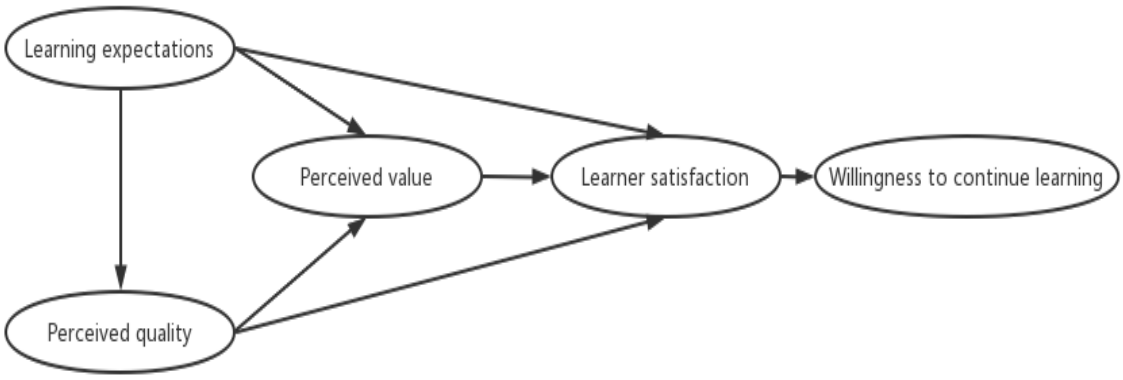

Figure 3: Research Framework (Author's Proposed)

RESEARCH METHODOLOGY

The researchers have set the research methodology to analyze the development of a causal model of factors affecting learner satisfaction with online teaching of primary school students in Beijing, China. There are 752 students in grades 4, 5 and 6 of C and D in Beijing. The sample is a combination of stratified sampling and random sampling. In the two schools' fourth, fifth and sixth grades, each grade randomly received two classes of primary school students. A total of 518 primary school students participated in the questionnaire survey, among which 5 students participated in the interview. The satisfaction index model of this study for the customer satisfaction model, the ACSI model applies the most widely, is more suitable for this study model, refers to the relevant literature, decided based on the customer satisfaction model, draws lessons from the core concept, combined with the influence factors of the pupil.

Table 1 shows the questionnaire which is adopted from the past studies of Zhang (2009), Guo (2016) and Wu (2020) and used five Likert scale of satisfaction questionnaires where perceived quality is divided into five large dimensions, all items a total of 33 questions, Likert scale is 1= strongly disagree, and five strongly agree.

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Table 1. Questions are classified by variables.

Variables		Questions
Learning expectation		Before starting, the online teacher would meet my expectations.
		Before I started, I was full of expectations for interacting with my teachers and classmates in online teaching.
		Before I started, I thought the online course resources could meet my online learning needs
		Before I started, I had high expectations for the online teaching environment (including equipment network, platform page functions and operations, etc.)
Perceived quality		Teachers have rich knowledge reserve and teaching experience
		Teachers are skilled in using online teaching platforms and tools
		Teachers are fully prepared for class, with various teaching methods and exciting class activities.
		The teacher arranges the teaching time and schedule reasonably, and the classroom order is good
	Teaching interaction	Teachers often ask us questions, initiate discussions, and give us a full opportunity to speak and communicate.
		When I ask the teacher questions, I can get the teacher's answer in time
		The teacher will evaluate my homework and study situation and tell me
		I often participate in online learning discussions, answering other people's questions or asking my own questions
		Other students and I are very happy to share learning resources or their own learning results
		Other classmates and I will evaluate each other's performance and others' performance and tell each other
	Course resources	The course content is reasonably arranged, the difficulty is moderate, and it is very easy to grasp
		Online resources (courseware, electronic textbooks, audio and video, etc.) are rich and diverse, and updated more timely
		I can get resources at any time during my study time
	Learning environment	The teacher is fully equipped in class, and the network can be kept smoothly (stable during live broadcast, smooth and clear in video, etc.)
		The design of the teaching platform (including the layout, navigation, etc.) is very clear and beautiful
		The platform is very easy to operate and use, convenient and fast
		The various functions of the platform (such as check-in, resource sharing, discussion, testing and evaluation, etc.) are relatively rich and complete
Perceived value		Online teaching can improve learning efficiency
		Online teaching can increase learning interest

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Variables	Questions
	Online teaching is helpful for me to learn my knowledge later
	Online teaching can improve my learning ability
Learner satisfaction	I am generally satisfied with the teachers teaching online
	I am satisfied with the interaction with my teachers and classmates in online teaching.
	I am generally satisfied with the course resources.
	I am quite satisfied with the network and the equipment and the online teaching platform.
Willingness to continue learning	If necessary, I am willing to continue to study online in the future
	I would like to recommend or share it with others who are not involved in online teaching
	If you choose between online and offline learning methods, I will choose online learning methods first
	In the process of online learning, I can consciously insist on online learning.

Source: Zhang (2009), Guo (2016) and Wu (2020).

The reliability analysis of the data obtained is presented in Table 2, indicating that learning expectation 0.727; perceived quality 0.903; perceived value 0.767, learner satisfaction 0.709 and willing to continue learning 0.785 shows the questionnaire is reliable statistically.

Table 2. Cronbach reliability analysis.

Name	Correction Total non-correlation (CIT)	Cronbach α Coefficient
Learning expectation	0.727	
Perceived quality	0.903	
Perceived value	0.767	0.908
Learner satisfaction	0.709	
Willingness to continue learning	0.785	

Table 2 shows that by performing Cronbach's alpha reliability analysis on 90 questionnaires using SPSS software, the value of Cronbach's alpha is 0.908, It can be found that 0.908> 0.9. Therefore, the questionnaire has a high-reliability value and enables further validity analysis.

In this study, factor analysis was used to test the construct validity of the questionnaire. In conducting a factor analysis. When, this study first used KMO, test and Bartlett spherical test on whether the original variables were suitable for factor analysis. As shown in Table 3.3:

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Table 3. KMO and Bartlett tests.

KMO value		0.878
Bartlett Sphelicity test	Approximate chi Square	2032.750
	df	528
	P value	0.000

It can be found from Table 3, with a KMO value of 0.878 and a significance level of p <0.001, the scale was considered suitable for factor analysis. The common value of all research items is higher than 0.4, indicating that the research information can be effectively extracted. In addition, the KMO value is 0.878, greater than 0.6, and the data can be effectively removed. In addition, the interpretation rate of variance after rotation is 17.062%, 16.932%, 16.918%, and 15.929%, respectively. The interpretation rate of cumulative variance after rotation is 66.842%, which means that the information of the study item can be effectively extracted. The factor load coefficient after rotation is obtained, as shown in Table 4:

Table 4. Flotation load coefficient.

Name	**Factor load factor**				**Common degree**
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	
Q5	0.709	0.233	0.418	0.157	0.757
Q10	0.667	0.344	0.143	0.372	0.722
Q16	0.551	0.197	0.292	0.481	0.659
Q21	0.603	0.290	0.308	0.334	0.654
Q9	0.280	0.671	0.208	0.344	0.690
Q11	0.233	0.544	0.229	0.525	0.678
Q17	0.176	0.669	0.331	0.345	0.706
Q18	0.441	0.627	0.293	0.106	0.685
Q19	0.420	0.424	0.374	0.287	0.579
Q6	0.272	0.456	0.628	0.107	0.687
Q8	0.374	0.311	0.546	0.294	0.621
Q13	0.250	0.208	0.707	0.311	0.703
Q15	0.232	0.191	0.604	0.500	0.705
Q20	0.339	0.367	0.449	0.337	0.565
Q7	0.343	0.333	0.212	0.617	0.654

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Table 4. Flotation load coefficient.

Name	Factor load factor				Common degree
	Factor 1	Factor 2	Factor 3	Factor 4	
Q12	0.357	0.352	0.386	0.445	0.598
Q14	0.247	0.251	0.341	0.678	0.700

Note: Color in the table: blue indicates absolute load coefficient greater than 0.4, and red indicates common degree (common factor variance) less than 0.4.

Interview method

The questions were mainly designed from the four dimensions of teacher quality, teaching interaction, course resources and learning environment. The specific topics are given as follows:

Course resources

1. What are the learning resources that the teacher gives you? Can it meet your learning needs?

2. Can you learn it at any time? Where is it not so convenient?

Learning Environment

1. What do you think of the device network in class? Does it have a significant impact on the class?

2. Have you encountered any difficulties in using the platform? Is it easy to check in, discuss tests, homework, and so on?

Teacher's quality

1.what do you think of the teacher's teaching level?

2.will the teacher use some platform tools to teach the class? Proficient in operation?

3.do you think the teacher manages the class well? Where is not so good?

Teaching interaction

1. is there much more interaction between teachers and students in class?

2. do you and your classmates discuss each other's performance?

Ensemble

1. Will online learning help you very much?

2. Do you like the online study? With any opportunity in the future, will you continue or prioritize online learning?

3. Would you like to recommend it to others?

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Data Collection

This study took the pupils of the fourth, fifth and sixth grades of C primary school and D primary school in Beijing, and there were 752 students of the fourth, fifth and sixth grades of C primary school and D primary school in Beijing. The questionnaires using the Chinese language were distributed on the " Stars " platform, and the students answered through mobile phones or computers. A total of five students were interviewed in the Chinese language. Information is provided in Table 5. The sample is stratified sampling and random sampling method in two schools of four, five, six, each grade random charges 1 class part of the students. Finally, a total of 93 pupils participated in the questionnaire survey, filled in all the same values and filled in the total time within 100 seconds of the invalid questionnaire, finally confirmed valid questionnaire 90, and questionnaire efficiency is 96.8%.

Table 5. Basic information of the interviewed students.

Code	Gender	School	Grade
A	Female	C	Four
B	Female	D	Six
C	Male	C	Five
D	Female	D	Five
E	Male	C	Four

Source: author survey, 2022

RESULTS

Table 6 shows the demographic information of the respondents as a total of 251 female and 263 male respondents. In terms of gender, 48.83% of the sample was "female" and 51.17 was "male". The ratio of men to women is close to 1:1. From the perspective of schools, the proportion of primary school C sample is 50%, and 50% is "D primary school". The number of the two schools is 1:1. In terms of grade, 33.27% are in fourth grade, 34.05% are in fifth grade, and 32.68% are in sixth grade. The number of the three grades is relatively average.

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Table 6. Demographic details.

Gender	Female	251	48.83
	Male	263	51.17
In the school	C primary school	257	50.00
	D primary school	257	50.00
In the grade	Fourth grade	171	33.27
	Fifth grade	175	34.05
	Sixth grade	168	32.68
Total		514	100.0

Source: author survey, 2022

The average satisfaction rate of this questionnaire survey is 3.648, and the score of 3 or above is considered to be satisfactory shown in Table 7 indicated that the average satisfaction of perceived value is the highest 4.067, while the average satisfaction of perceived quality is the lowest 3.628. the average value of satisfaction in each dimension was from high to low: perceived value (4.067)> learning expectation (4.002)> willingness to continue learning (3.831)> learner satisfaction (3.721)> perceived quality (3.628).

Table 7. Satisfaction status of each variable.

Name	Sample capacity	Least value	Crest value	Average value	S.d	Median
Learning expectation	514	1.000	5.000	4.002	0.798	4.250
Perceived quality	514	1.706	4.706	3.628	0.880	3.941
Perceived value	514	1.000	5.000	4.067	0.792	4.250
Learner satisfaction	514	1.000	5.000	3.721	0.871	3.750
Willingness to continue learning	514	1.250	5.000	3.831	0.838	4.000
Total	514	1.606	4.758	3.762	0.634	4.000

Table 8 shows the learning expectation statistics, It can be seen that the total average of this dimension of learning expectation is 4.002, The dimensions corresponding to the score value from high to low are: Expectations of the class effect of teachers (4.179)> Expectations of the learning environment (4.078)> Expectations of interaction between teachers and classmates (3.942)> Expectations of course resources (3.809)> Expectations of course resources (3.809).

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Table 8. Learning expectation.

Name	Sample capacity	Least value	Crest value	Average value	Standard error	Median
Before the start, i think the class results of the online teaching teachers can meet my expectations	514	1.000	5.000	4.179	0.917	4.000
Before starting, i have full of expectations for the interaction with teachers and classmates in online teaching	514	1.000	5.000	3.942	1.017	4.000
Before i started, I think the online course resources can meet my online learning needs	514	1.000	5.000	3.809	1.055	4.000
Before the start, i have full expectations for learning environment (including device network, platform page functions and operations, etc.)	514	1.000	5.000	4.078	0.970	4.000
Total	514	1.000	5.000	4.002	0.798	4.250

Source: author survey, 2022

Table 9 shows that the mean satisfaction value for the perceived quality statistics is 3.628, For course resources perceived quality (3.710)> learning environment perceived quality (3.623)> perceived quality for teaching interaction perceived quality (3.593)> for teaching interaction perceived quality for teacher's quality (3.587).

Table 9. Basic indicators of perceived quality.

Name	Sample capacity	Least value	Crest value	Average value	S.D.	Median
Q5	514	1.000	5.000	3.712	1.152	4.000
Q6	514	1.000	5.000	3.630	1.156	4.000
Q7	514	1.000	5.000	3.751	1.163	4.000
Q8	514	1.000	5.000	3.747	1.147	4.000
course resources	514	1.000	5.000	3.710	0.956	4.000
Q9	514	1.000	5.000	3.615	1.181	4.000
Q10	514	1.000	5.000	3.737	1.148	4.000
Q11	514	1.000	5.000	3.516	1.196	4.000
Q12	514	1.000	5.000	3.669	1.181	4.000
Q13	514	1.000	5.000	3.580	1.151	4.000

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Name	Sample capacity	Least value	Crest value	Average value	S.D.	Median
learning environment	514	1.000	5.000	3.623	0.940	4.000
Q14	514	1.000	5.000	3.650	1.130	4.000
Q15	514	1.000	5.000	3.502	1.188	4.000
Q16	514	1.000	5.000	3.595	1.166	4.000
Q17	514	1.000	5.000	3.488	1.198	4.000
Q18	514	1.000	5.000	3.700	1.148	4.000
teacher's quality	514	1.000	5.000	3.587	0.930	3.800
Q19	514	1.000	5.000	3.562	1.172	4.000
Q20	514	1.000	5.000	3.675	1.147	4.000
Q21	514	1.000	5.000	3.543	1.188	4.000
teaching interaction	514	1.000	5.000	3.593	0.980	3.667
Total	514	1.706	4.706	3.628	0.880	3.941

Source: author survey, 2022

As shown in Table 10, it can be seen that the average satisfaction of perceived value statistics is 4.067, with 4 questions, each question corresponds to one dimension. The cost performance of online teaching (4.200)> Online teaching ability exercise (4.111)> Interest in online teaching (4.023)> practicability of online teaching (3.932).

Table 10. perceived value, the underlying indicators.

Name	Sample capacity	Least value	Crest value	Average value	S.D.	Median
Online teaching can improve learning efficiency	514	1.000	5.000	4.200	0.945	4.000
Online teaching can improve the interest in learning	514	1.000	5.000	4.023	0.971	4.000
Online teaching is helpful to my subsequent knowledge learning	514	1.000	5.000	3.932	1.027	4.000
Online teaching can improve my learning ability	514	1.000	5.000	4.111	0.968	4.000

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Name	Sample capacity	Least value	Crest value	Average value	S.D.	Median
Total	514	1.000	5.000	4.067	0.792	4.250

Source: author survey, 2022

As shown in Table 11, it can be found that the average value of learner satisfaction is 3.721, among which the teacher satisfaction with online teaching (3.903)>the network and equipment platform of online teaching (3.796) > the interaction with online teaching (3.661)> the course resources satisfaction with online teaching (3.523).

Table 11. Basic indicators of learner satisfaction.

Name	Sample capacity	Least value	Crest value	Average value	S.D.	Median
I am generally satisfied with the online teaching teachers	514	1.000	5.000	3.903	1.027	4.000
I am satisfied with the interaction between teachers and classmates in online teaching.	514	1.000	5.000	3.661	1.100	4.000
I am generally satisfied with the course resources.	514	1.000	5.000	3.523	1.112	4.000
I am satisfied with the network, equipment and online teaching platform.	514	1.000	5.000	3.796	1.041	4.000
Total	514	1.000	5.000	3.721	0.871	3.750

Source: author survey, 2022

Table 12, Use the t-test (full-called independent sample t-test) to study gender for learning expectation, perceived quality, perceived value, learner satisfaction, and willingness to continue learning, The overall difference of 6 items, As can be seen from the above table: mean of overall female (3.49) <mean of male (4.02), And different gender for learning expectation, perceived quality, perceived value, learner satisfaction, willingness to continue learning, Overall all were significant ($p < 0.05$), Means that different gender samples for learning expectation, perceived quality, perceived value, learner satisfaction, willingness to continue learning, There are overall differences.

Table 12. Difference Analysis of online teaching satisfaction in primary school students.

	1. Your gender: (mean value ± S.D.)		*t*	*p*
	Female (n =251)	Male (n =263)		
Learning expectation	3.79±0.86	4.20±0.68	-5.904	0.000**
Perceived quality	3.39±0.95	3.85±0.74	-6.073	0.000**
Perceived value	3.79±0.88	4.33±0.59	-8.056	0.000**
Learner satisfaction	3.56±0.94	3.88±0.77	-4.218	0.000**
Willingness to continue learning	3.21±0.59	4.42±0.57	-23.494	0.000**

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	1. Your gender: (mean value ± S.D.)		*t*	*p*
	Female (n =251)	**Male (n =263)**		
Total	3.49±0.67	4.02±0.47	-10.459	0.000**

The adaptation of the model will be based on the evaluation criteria in the model adaptation index summary table in the Structural Equation Model, and whether the model is adapted to the sample data one by one. The parameters are shown in Table 13.

Table 13. Model fit values established at the first time.

Adaptation index	Model fit values	Adaptation standard
CMIN/DF	1.293	< 3
RMR	0.09	< 0.05
RMSEAR	0.024	< 0.08
GFI	0.932	> 0.9
CFI	0.983	> 0.9
IFI	0.983	> 0.9
TLI	0.982	> 0.9
PGFI	0.811	> 0.5

The standard model fit value uses the standard model fit value described by Xu (2018) in his paper "Online Course Research - Questionnaire Based on NJAU".It can be seen from the comparison of the initial model adaptation value and the index standard value reflected in the index adaptation results in the table above, that all others meet the standard value except RMR> 0.05, which does not meet the standard value. It shows that the theoretical model does not have a good fit, and its indicators do not support the recognition of the model, so further analysis should be combined with the relevant pathways within the model.

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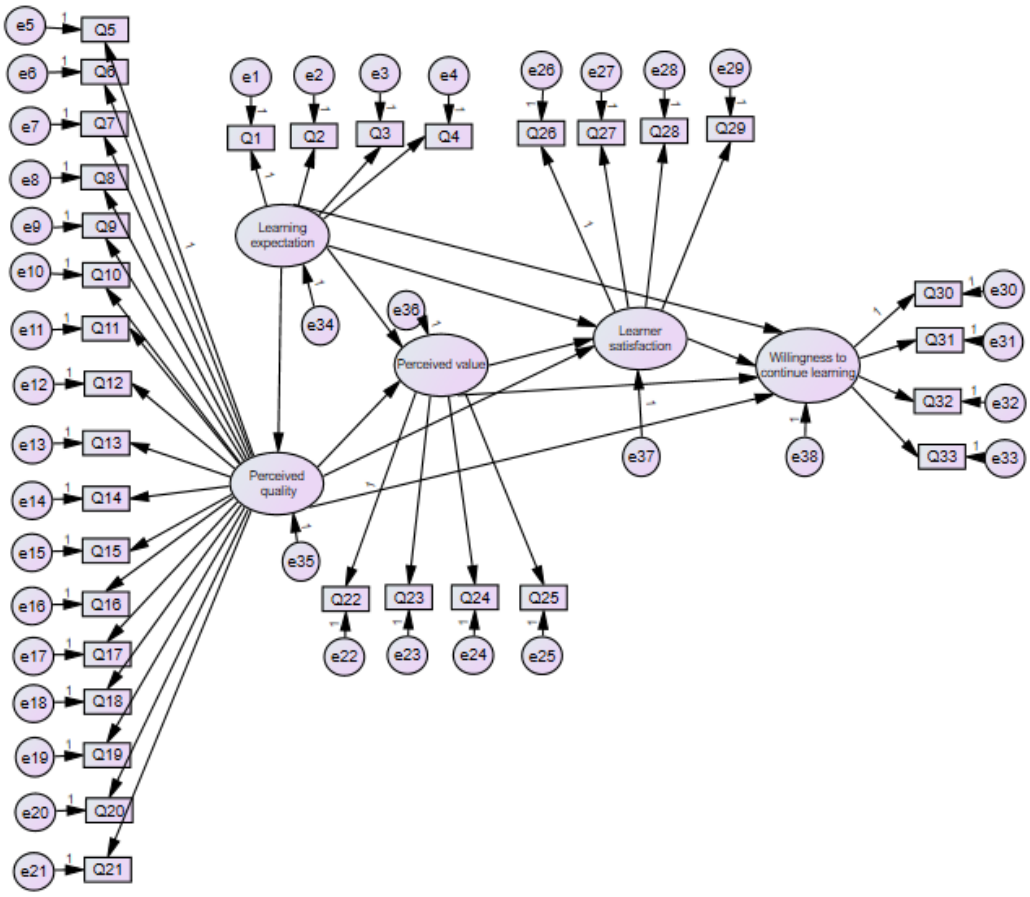

Figure 4: The second casual model of factors affecting learner satisfaction with online teaching of primary school students in Beijing China

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Interview survey, a summary of results

The interview results of the five students are summarized and shown in Table 15

Table 15. Summary table of the interview results.

Dimension	Summary of the results of the interview content
Course resources ：	The resources given to us include courseware, teaching design, electronic teaching materials, recorded courseware videos and related resources, including some extended learning materials, which are very helpful and can generally meet the needs. However, some courses are only live broadcast, without course playback, so the review is relatively inconvenient. Course resources Can learn at any time, but sometimes will forget to see,
Learning environment	When the equipment network is generally good, the teacher answers the questions, but sometimes there are not smooth delay situation, such as the online platform is more convenient to assign homework, the teacher can correct my homework at a glance, but sometimes the homework cannot be submitted
Teacher's quality	Teachers do not understand the platform operation at the beginning, and then will use; like to interact with teachers, some teachers sometimes speak too fast, and some teachers are not too serious, only their own class in class, regardless of students.
Teaching interaction	Can ask questions and discuss, use voice and text, but feel not very convenient, activity discussion to normal class content, less than offline class; can control the time; after class can also answer questions for students, homework feedback is sometimes slow, and less interaction between students, and even some basic no communication about learning.
Ensemble	Online learning is helpful. I am willing to continue to choose online learning. If there is a need and interest, it is quite convenient.

Source: author survey, 2022

From Table 15, it can be found that students communicate more about teaching interaction, which affirms the teaching interaction of teachers, but also believes that there is less teaching interaction in online teaching, homework feedback is slow, and peer interaction is not able to meet the needs, indicating that students attach great importance to teaching interaction. It is believed that the curriculum resources can basically meet the needs, and the teaching environment and teachers' quality are generally recognized. The model is basically established, but the model has some corrections according to the empirical data.

DISCUSSIONS

In the validation results H1-H7 of the hypothesis of this study, the validation results other than H3 are the same as those of Xu (2018) in his paper. The hypothesis results of H3 are not tenable, which is consistent with the research conclusion of Wang et al. (2022) in the hypothesis verification results of H8-H10 are consistent with the conclusions of Wang et al. (2022).

Guo (2016) found that perceived quality and perceived value have a significant positive impact on learner satisfaction, and perceived value has a greater impact on learner satisfaction. The conclusion of this study is consistent with it. Perceived value has the greatest impact on learner satisfaction, and the path coefficient is 0.345, that is, the value of online courses on learners and the subsequent impact. If the courses cannot meet the learning needs of pupils and bring learning value, it will greatly affect the satisfaction of pupils with online teaching to a large extent.

Therefore, online teaching designers or online teaching platform developers should reflect on, developers in the development of specific courses should increase practical consideration from the perspective of the needs of pupils, considering the age, psychological characteristics and development design meet the learning needs or can bring practical value for pupils, make students can learn after learning courses, improve their interest in learning, in their learning growth road can produce certain positive influence and play a certain role.

Perceived quality has a great impact on learning satisfaction, with a path coefficient of 0.223, which shows the students' feelings about the teaching quality in the teaching process. Including primary school students 'feelings about teacher quality, teaching interaction, course resources and learning environment will affect the size of pupils' satisfaction with online teaching. Therefore, in online teaching, teachers should carefully prepare the teaching content, be skilled in the technology application in the teaching platform, strengthen the teaching interaction between teachers and students, collect and make more excellent course resources, and try to provide a high-quality learning environment for primary school students.

The findings of the study are consistent with Wang et al., (2022) as stated that learning expectations would not have a positive impact on learners' satisfaction. Learning expectation does not directly affect learning satisfaction; however, learning expectation has a positive effect on perceived quality.

Teachers' teaching methods and information technology skills, the design of the online teaching platform, course resources, online interaction is constantly being explored, which creates a large gap between pupils' expectations of online teaching and the actual online teaching. learner satisfaction, learning expectation, perceived quality, and perceived value all had significant positive effects on willingness to continue learning.

CONCLUSION DISCUSSION AND RECOMMENDATIONS

The satisfaction score of Beijing primary school students in China is 3.762, which is close to the satisfaction of learners who "agree" with online teaching. This study's conclusion is consistent with the past studies. This shows that the overall design and implementation of course resources, learning environment, teacher quality and teaching interaction in online teaching in Beijing, China are relatively

reasonable. At the same time, according to the different tests and analyses, different gender satisfaction has a significant difference, such as satisfaction average overall, female average (3.49) <male average (4.02).

Teachers should pay attention to the needs of students, especially the different gender characteristics of students, according to the actual self-learning to provide lecture screens and PPT courseware. Secondly, in addition to providing the above self-made teaching resources, we should also make full use of cutting-edge and novel high-quality online teaching resources in the subject field. Through careful screening and reasonable push, students can analyze and think from multiple perspectives, and also reduce the burden of teachers' course recording. Thirdly, providing a variety of course resources can also include the learning and training resources for learners 'listening, speaking, reading and writing, which can capture the interesting content of learners' attention, and can be static or dynamic, text or audio and video resources. Finally, it should be noted that the course resources provided should meet the development needs of students, and the difficulty should be gradually increased from the pre-class preview and class practice to consolidation and improvement after class.

Teachers must keep pace with the times, constantly learn and enrich new online teaching skills to ensure the smooth development of online teaching. In addition to the production and demonstration of basic PPT, teachers also include the collection and processing of all kinds of materials (pictures, videos, sounds) for online teaching, the operation of online teaching platforms, and the usage of various online learning software.

FUTURE RESEARCH

This study improves the relevant theories and models of online teaching and provides theoretical support for the development of online teaching. This study is based on primary school students and carries out relevant research and analysis on their satisfaction with online teaching. It can find the problems in online teaching from the perspective of primary school students, analyze the similarities and differences between online and offline teaching, and provide valuable reference for better online teaching. This is not only conducive to helping teachers improve the teaching quality of online teaching and find suitable teaching methods for online teaching, It is also helpful for teachers to have a deeper understanding of the characteristics of online teaching, and ultimately improve the satisfaction of primary school students with online teaching, which is of great practical significance for the future development of better online teaching.

Authors contribution

Song Yujun is responsible for Writing - Original Draft， Formal analysis.
Nuttamon Punchatree is responsible for Writing - Review & Editing and Methodology.
Sirikorn Tosati is responsible for Supervision and Validation.

Data (and Software) Availability

All data included in this study are available upon request by contact with the corresponding author.

Competing Interests

Upon the publication of this study, no conflict of interest was declared by the researchers.

Ethical Statement

Prior to the conduct of this research work, the researchers obtained approval by approval from Beijing C Primary School, Beijing D Primary School, and Beijing Municipal Education Commission before each qualified participant was interviewed. The management of each selected primary school granted the request of the researchers. The researchers conducted a face-to-face interview with the participants. During interview, the researchers took notes of the responses of the participants.

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