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Post-pandemic era user experience model and technology acceptance for online teaching platforms in China

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Abstract

In the context of the global COVID-19 pandemic and its aftermath, online teaching has become an indispensable component of the education sector. However, with the widespread adoption of online teaching, schools, teachers, students, and parents face numerous challenges in accessing, utilizing, and evaluating online teaching platforms. One of the most pressing issues is the inadequacy of user experience and the lack of a tailored user experience model. This study, taking the Chao Xing Online Teaching Platform as an example, delves into the construction and optimization of user experience for online teaching platforms. By integrating the content structure of user experience, relevant theoretical models, and the functional characteristics of online teaching platforms, this research formulates a User Experience Model specifically for the Chao Xing Online Teaching Platform. This model incorporates key factors from teacher evaluation models and integrates the theoretical framework of the Technology Acceptance Model, aiming to provide users with clearer and more systematic navigation and an enhanced online teaching experience. The goal of this study is to provide guidance for developers of the Chao Xing Online Teaching Platform in terms of design and development, prioritize user experience, and elevate construction standards, ultimately creating a superior and satisfying online teaching environment that lays a solid foundation for the future development of intelligent teaching.

Keywords: Digital innovation, Online teaching platforms, Post-pandemic Era, Quality education, Technology acceptance model (TAM), User experience model (UEM).

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1. Introduction

The widespread adoption of Information and Communication Technology (ICT) has become a hallmark of the current educational landscape, and its position across the globe is unshakable [1]. ICT-based Online Teaching Platforms (OTP) have become vital for teaching and communication between educators and students during COVID-19, prioritizing student safety and participation in teaching activities. These platforms offer supplementary materials unavailable in traditional offline courses, enhancing teacher-student communication [2]. The pandemic has fundamentally changed teaching paradigms, rapidly making online education the primary means rather than a supplementary tool. While OTP offered crucial support during the pandemic and introduced novel experiences, they also generated significant controversy due to issues such as MOOC platform failures, learning time submissions, and server crashes [3]. To understand the core issues at the heart of these controversies, it's vital to analyze how user concerns have evolved before and after the pandemic. Academic research on online teaching has been extensive, covering construction models, current status, issues, effectiveness, strategies, and sharing best practices. However, despite this extensive research, there's still a limited understanding of the post-pandemic implementation of User Experience (UE/UX) for teacher users on OTP, especially in the context of extended online teaching periods. UE significantly impacts teaching objectives, instructional design, and organization due to its connection with users' continuous usage behaviour.

The COVID-19 pandemic has profoundly impacted approximately 1.5 billion pupils in 191 countries, affecting all levels of education [4]. It has also had a significant impact in China. The statistics indicate that 9.5 million teachers are conducting 9.42 million Online Teaching Activities (OTA) across 1,454 colleges and institutions. Impressively, a staggering 1.18 billion students have actively participated in these online learning opportunities [5]. The size, scope, and depth of this online teaching practice represent both the first global experiment and a historic exploration in the field of higher education.

In 2016, Sichuan Tourism University (S University) took steps to align with the national "Internet Plus" development strategy, aiming to foster a seamless integration of modern information technology and higher education teaching. As part of this effort, the university introduced the Chao Xing Online Teaching Platform (CX-OTP) (Figure 1) to benefit both educators and students. CX-OTP stands out as an advanced Online Teaching Platform (OTP) that offers a "one-platform-three-terminal" teaching system encompassing classroom, mobile, and management terminals. This integration effectively facilitates data sharing and forms a smart teaching system, combining online teaching with a plethora of digital resources. This open form of OTP serves as a valuable tool for auxiliary teaching and learning processes, enabling teachers to establish an efficient organic teaching network space for their students. This approach liberates learners from the constraints of time and space, granting them the flexibility to access planned courses at any time and from anywhere. Consequently, this innovative approach significantly enhances the overall teaching effectiveness at S University.

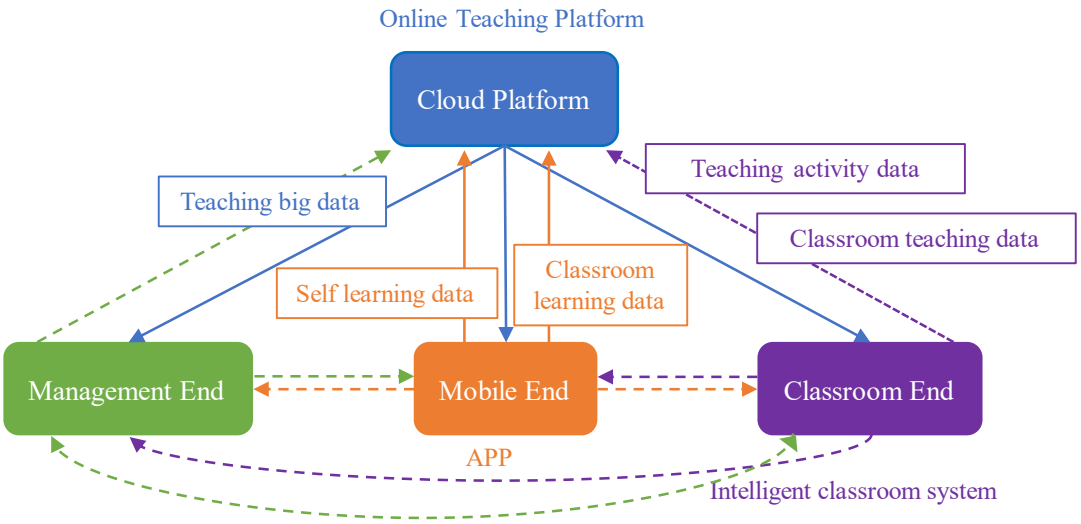

Figure 1.
Chao Xing online teaching Platform, One Platform, Three Ends.

It presents both a chance and a difficulty. The teaching and learning process has been significantly altered by modern information technology, which has changed the "teaching" of teachers, the "learning" of students, the "administration" of schools, and the "form" of education. During the pandemic, many educational institutions had to swiftly transition to online teaching modes in response to school closures and social distancing requirements, ensuring that students could continue their studies. This further accelerated the rapid proliferation and development of online education. Due to the massive demand for online teaching, certain office-meeting software, such as Ding Talk, has actively improved its features. As a result, it has become a popular platform for teachers and students to engage in online teaching activities alongside other education platforms [6].

While teachers and students have engaged with and practiced Online Teaching Activities (OTA), online teaching resources have grown rapidly. However, challenges have arisen for educational institutions and teachers; education must be redesigned, and teaching methods must change to cope with the mandatory requirement to use technology to enable OTA. Because OTA demands various conditions in terms of course design and delivery, technical infrastructure, etc., it frequently leaves institutions, educators, and students unprepared.

The key to gaining recognition for CX-OTP lies in its user experience, particularly from the perspective of the primary users: the teachers. College teachers, being the designers and implementers of OTA in higher education, play a crucial role in its development and future progress. The change in teaching mode has enriched teachers' careers and improved their teaching skills. However, the teacher is the main body of online teaching, especially in terms of their long-term online teaching user experience. The suddenness of the epidemic has increased the difficulty for teachers to implement online teaching, often receiving less attention, despite its close relationship with users' continuous use behavior. Understanding and improving the User Experience (UE/UX) becomes crucial as it significantly impacts the achievement of teaching objectives and the overall design and organization of OTA.

Online teaching environments involve Information and Communication Technologies (ICT), and research on technology acceptance in online teaching has emerged as an attractive trend, emphasizing its importance in integrating it into online education [7, 8]. Over the years, the Technology Acceptance Model (TAM) (Figure 2) has established itself as a prominent scientific framework for studying the adoption of educational technology among students, teachers, and other involved parties [9]. Based on TAM, the College Teachers Online Teaching User Experience Model (CT-OTUEM) was constructed. The Online Learning Status of Students (SOLSOS), Online Teaching Investment (OTI), Online Teaching Experience (OTEx), Online Teaching Support (OTS), and Online Teaching Environment (OTEn) are taken as external variables. The internal variables, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), remain unchanged, while the Attitude Toward Using is influenced by User Experience (UE). In this paper, teachers at S University using the CX-OTP are taken as research subjects, and data were obtained through a questionnaire survey and sample data were analyzed. The structural equation model of CT-OTUEM was constructed. It is of great significance to study the UE of college teachers' OTA, improving their ability and promoting the reform of college informatization teaching.

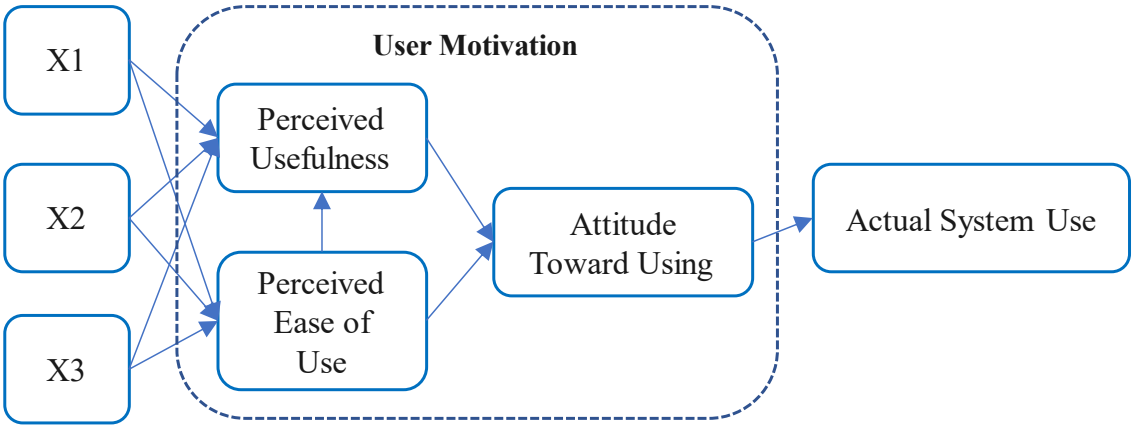

Figure 2.
Technology Acceptance Model, TAM.

2. Literature Review

2.1. User Experience

Experience usually refers to the inner feelings of the parties caused by external things and situations. It is both an activity and a result. It is the emotional cognition obtained by the subject from personal experience [10]. The theory and method of User Experience (UE/UX) originally originated and were applied in human-computer interaction design. Now it has been widely used in the design of various products and services; it is an interdisciplinary concept across multiple subject areas. What is UE? In this regard, researchers in different fields give different definitions. Norman first put forward the concept of UE and pointed out that a successful user experience must ensure that products meet users' needs, that products are simple and elegant, that products make customers happy to use, that products make users happy to own, and that products bring extra surprises to users [11]. Due to the interdisciplinary nature of UE, there has been no agreement between academia and industry on its definition to date.

The definition of User Experience (UE) by the International Organization for Standardization (ISO) is highly recognized in academia and industry. UE is described as the subjective emotions and reactions produced by users when using or anticipating utilizing a product, system, or service in the ISO 9241-210 standard [12]. The standard emphasizes that human-centered design is an interactive approach to system development that aims to make systems usable and useful by concentrating on users, their needs, and requirements, as well as by utilizing knowledge and techniques from the fields of human factors/ergonomics and usability. After ten years of research and development, the ISO now states that UE encompasses all pre-use, in-use, and post-use feelings, thoughts, beliefs, preferences, cognitive impressions, physical and psychological reactions, behaviors, and outcomes. It is intended to be used by those who manage the design process and focuses on how the hardware and software components of interacting systems can enhance the way people interact with systems [13].

This paper mainly studies the use of CX-OTP teacher's UE, so it directly applies the Information System user experience concept. Information System (IS) User Experience refers to all the subjective feelings of users before, during, and after using the information system.

The necessity for meaningful integration of technology in educational settings is also emphasized [8].

2.2. Research Theory and Research Model of User Experience

UE is the user's perception of system quality characteristics. "System Quality" is defined by the Chinese National Standard as "the ability to meet explicit and implicit requirements," with eight-dimensional characteristics of functionality, performance efficiency, ease of use, compatibility, reliability, information security, maintainability, and portability. The research theories involved in the existing research mainly focus on information science, pedagogy, sociology, and other disciplines. The research based on the perspective of technical analysis tends to choose the classic theories and models in the field of IS/IT, such as the Technology Acceptance Model (TAM), the Information System Success Model (IS-SM), the Expectation Confirmation Model (ECM), and the Information System Continuous Use Model (IS-CUM).

Researchers have put forward a variety of user experience models, which are mainly divided into three categories from the research perspective: constructing the UE model from the technical point of view and guiding the user experience design within the system. The five-layer element model of user experience was proposed by Garrett [14]. The User Experience Honeycomb was proposed by Morville and Callender [15]. Constructing the UE model from the user's perspective allows for the analysis and extraction of the user's understanding of the system's meaning. The APEC model was proposed by Vyas and Veer [16]. The last category, represented by the research framework of the user experience process, is to build a user experience model from the application perspective to help system managers identify the phased problems in the application process of the system and provide targeted positive guidance to the user experience. In the Technology Acceptance Model (TAM) [17], Davis F. D. considers perceived usefulness and perceived ease of use as important factors for user acceptance of the system. This paper mainly studies the UE of college teachers when conducting OTA, and the UE brought by various external and internal factors during the OTA of teachers, which leads to the Actual System Use of the CX-OTP by teachers. Therefore, the UE process is mainly adopted as the research object, based on the representative TAM model.

3. Hypothesis and Theoretical

3.1. Influence of User Experience on User's Actual System Use

At present, many mature theories have explained the impact of user experience of information systems on the actual system use; among them, the representative is the TAM, as shown in Figure 1, and a series of derivative models formed by TAM after integrating relevant theories. TAM is developed and formed on the basis of the Theory of Planned Behavior [18] and the Theory of Rational Action [19] which can be used to explain what factors affect users' actual system use. TAM tracks the impact of external variables of the system on perceived usefulness and perceived ease of use and points out that perceived ease of use has a positive impact on perceived usefulness, which jointly affects the use attitude, thus affecting the user's actual system use. The problems studied by TAM are relatively important in the field of information technology, attracting many scholars to apply and verify. For example, the TAM2 model, UTAUT integrated technology acceptance model, and the TAM3 model. Over time, TAM has developed into a crucial framework for comprehending how predictors of human behavior might embrace or reject technology.

The necessity for meaningful integration of technology in educational settings was also emphasized Scherer et al. [8] in the context of COVID-19, where research on technology adoption in teaching environments has emerged as an appealing trend [7]. Although the potential for ICTs to improve learning and teaching processes is intuitively enticing, teachers must consider whether online teaching activities are technologically acceptable or not [9].

The most prevalent theory in the literature on e-learning adoption, the Technology Acceptance Model (TAM), has emerged as the leading scientific paradigm for examining how learners, educators, and other stakeholders perceive new learning technology. Some theoretical studies that synthesize empirical research, particularly retrospectives and meta-analyses, concentrate on specific issues in the field of education. For instance, meta-analyses that deal with TAM when predicting teacher adoption of technology [8] and systematic literature reviews of TAM in a mobile learning environment [7]. The research on TAM application in the educational arena is clearly not in its infancy in view of the aforementioned factors. However, the area still lacks thorough research on the practices and tools that underpin TAM research, as well as distinct iterations of various learning domains, learning technologies, and user types in the educational setting.

In this paper, the TAM model is used as the theoretical model prototype. On the one hand, the model optimization strategy of this paper was determined by investigating the TAM optimization path of relevant researchers. On the other hand, the conclusion of combining the TAM optimization model with education is used as the theoretical basis of this paper to adjust the model structure and screen the model parameters. Finally, the model hypothesis is proposed: College Teachers' Online Teaching User Experience Model (CT-OTUEM).

3.2. Model Design

In the vast majority of analytical studies, college students are the most frequently selected sample group, indicating that most empirical data is collected at universities [9]. As OTA is completely online, it changes the process of students' knowledge and skills development and knowledge construction, and students' social interaction with educators and peers is limited. Students have to face the reality of isolated social interaction and limited educational interaction in order to adapt to the fact that the implementation of the educational activities process must be carried out through OTP [20, 21]. Their classroom environment is their home, and whether they have their own independent study space is crucial to the development of OTA [22] Students' existing equipment, such as smartphones, laptops, personal computers, and flat books, students' familiarity with communication technology, attitude towards accepting new technology, and whether the school will train students on the use of OTP [23]. Students can use OTP for pre-class preview, homework, discussion, examination, communication, and sharing of learning experiences with teachers and students [24]. During OTA, are students willing to turn on the camera and sound, respond to the class in real-time, and share the screen [25]. Various situations of students will have a substantial impact on teachers' OTA implementation. Therefore, this paper takes the Online Learning Status of Students (OLSOS) as one of the external variables.

Educators are also faced with some technical challenges. Teachers are prepared to use technology and distance teaching, design course materials, teaching links, and digital resources in the distance teaching environment, and prepare course materials suitable for students' learning conditions in the face of a large amount of digital resources available on the network [26]. There is a significant gap between Online Teaching Approaches (OTA) and traditional face-to-face teaching. In the case of demonstration, it is necessary to carefully design course links, stimulate students' enthusiasm, organize rich interactive activities, respond to students' inquiries immediately, distribute pre-class tasks, and collect and evaluate homework [26, 27] Online Teaching Platforms (OTP) can record students' behavior data, analyze students' learning data effectively, and gather feedback on students' learning regarding the course. In this paper, teachers' Online Teaching Investment (OTI) is considered as the second external variable.

Schools and teachers are fully aware of the advantages of OTA. When teaching through OTP for the first time, they are bound to encounter many difficulties, including ideological problems from students, technical problems from OTP, and issues stemming from their own experience. In general, it is challenging to complete the job at the beginning. With certain OTA experience, teaching activities can be carried out smoothly. When problems arise, teachers can quickly identify issues and find solutions, ensuring a good user experience. This skill will continue to exist after OTA [28]. This paper takes teachers' Online Teaching Experience (OTEx) as the third external variable.

Teachers' digital literacy can also affect their experience. Teachers' different levels of computer operation make it difficult to locate, evaluate, and appropriately use technological tools to teach, learn, and communicate with students [26, 27]. Whether the organization will train teachers on the use of OTP is uncertain. Is there a specific teaching team or colleagues who regularly communicate and share OTA teaching experiences [29]? Whether the staff of OTP can help teachers solve

technical problems in OTA in a timely and effective manner and other supporting activities is also a consideration. This paper considers Online Teaching Support (OTS) as the fourth external variable.

Like students, the teaching environment for teachers is also at home. Most teachers live with their families and need relatively independent teaching space [22]. Teachers' readiness for teaching equipment, communication, and their acceptance and operational level of new technologies also limit their user experience [23]. OTP services, such as convenient access to the teaching platform, fast operation, jump speed, high efficiency, and OTA through OTP multi-terminal, are essential. The OTP surface layout is appropriate, with font design, color design, and other aesthetic considerations, reasonable column settings, and clear navigation bar settings. OTP provides course reminders, check-in activities, and other services. Teaching materials can be uploaded and downloaded conveniently and quickly, with network storage capacity. It is convenient for teachers and students to exchange, interact, and evaluate each other. The OTP resource retrieval operation is simple and can easily obtain many similar teaching resources and auxiliary online teaching activities. On the premise of ensuring accuracy, the fast retrieval of resources is realized. The results of recommended retrieval are comprehensive, reasonable, and highly relevant. OTP can complete the assignment of learning tasks, homework assignments, course examinations, after-class experiments, course invigilation, and other operations. It records student learning data and analyzes the data. The above is summarized as the Online Teaching Environment (OTEn), which is regarded as the fifth external variable in this paper [30].

The aforementioned five external factors will have a direct impact on users' perceptions of the system's usefulness and usability, as well as their feelings of self-efficacy and user experience. They will also have an impact on how the system is actually used. This study's division of the online teaching environment, online teaching support, online teaching experience, online teaching investment, and online teaching status of students is based on the TAM theory. The internal dimension is divided into perceived ease of use and perceived usefulness. Figure 3 displays the preliminary model assumptions.

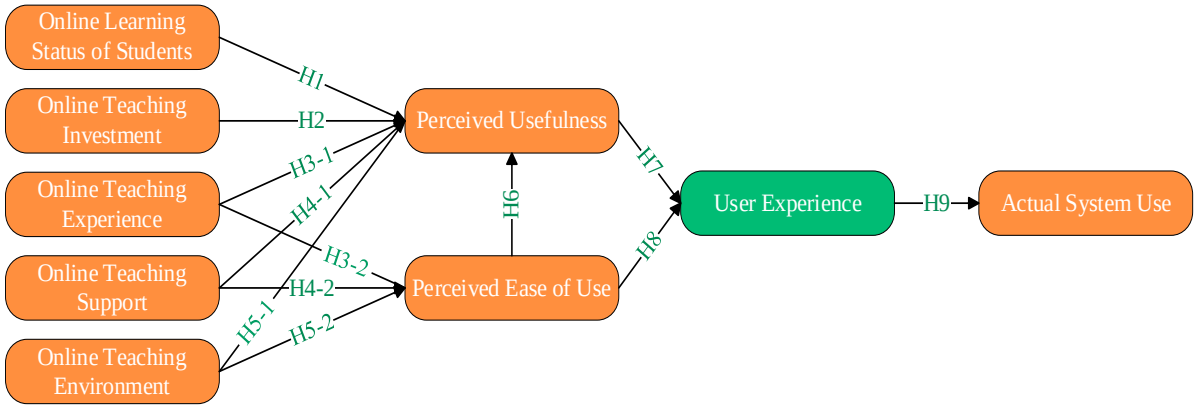

Figure 3.
Preliminary model assumptions.

Table 1.
Variable definition.

Variable	Definition	Reference
Online Learning Status of Students (OLSOS)	Conduct OTA, what kind of devices students use, network communication situation, learning environment, use of OTP, keep the camera on during the class, actively communicate with teachers and classmates, and complete the relevant exercises of the course.	Al-Nuaimi and Al-Emran [7]; Scherer, et al. [8]; Granić and Marangunić [9]; Davis [17]; Lee and Jung [24]; Adedoyin and Soykan [27]; Marangunić and Granić [31] and Venkatesh, et al. [32]
Online Teaching Investment (OTI)	Measures the UE of college teachers' online teaching input from the aspects of teachers' cognitive input, emotional input and behavioral input.	
Online Teaching Experience (OTEx)	In OTA, teachers often rely more on the existing teaching experience and understand OTA and online teaching experience will affect the formation of behavioral intention to a certain extent.	
Online Teaching Support (OTS)	College support and group orientation within the organization have a positive and significant impact on college teachers' OTA, support and help provided by schools, colleagues, and technicians.	
Online Teaching Environment (OTEn)	The internal feelings of college teachers on many elements of the online teaching environment, such as network conditions, OTP functions, online teaching equipment, etc. Focuses on the network status and the usefulness of the OTP functions.	
Perceived Usefulness (PU)	College teachers can complete teaching tasks with quality and quantity guaranteed when using online teaching platforms. From the perspective of teaching quality, teaching means, teaching organization, teaching evaluation, etc.	
Perceived Ease of Use (PEOU)	Computer self-efficacy and the online teaching environment jointly affect college teachers' perceived ease of use in online teaching.	
User Experience (UE)	The internal feeling of users using OTP.	
Actual System Use (ASU)	Whether university teachers are willing to continue to use the OTP and maintain the "long-term willingness to continue to use" for a long time.	

Table 2.
Model assumptions.

Serial number	Assumptions
H1	Online Learning Status of Students has a significant positive effect on Perceived Usefulness
H2	Online Teaching Investment has a significant positive effect on Perceived Usefulness
H3-1	Online Teaching Experience has a significant positive effect on Perceived Usefulness
H3-2	Online Teaching Experience has a significant positive effect on Perceived Ease of Use
H4-1	Online Teaching Support has a significant positive effect on Perceived Usefulness
H4-2	Online Teaching Support has a significant positive effect on Perceived Ease of Use
H5-1	Online Teaching Environment has a significant positive effect on Perceived Usefulness
H5-2	Online Teaching Environment has a significant positive effect on Perceived Ease of Use
H6	Perceived Ease of Use has a significant positive effect on Perceived Usefulness
H7	Perceived Usefulness has a significant positive effect on User Experience
H8	Perceived Ease of Use has a significant positive effect on User Experience
H9	User Experience has a significant positive effect on Actual System Use

3.3. Research Definition

Variables in this article contain Online Learning Status of Students (OLSOS), Online Teaching Investment (OTI), Online Teaching Experience (OTEx), Online Teaching Support (OTS), Online Teaching Environment (OTEn), Perceived Usefulness (PU), Perceived Ease of Use (PEOU), User Experience (UE), and Actual System Use (ASU). The variable definitions are shown in Table 1.

3.4. Hypothesis

Through the literature review and model design, the following variable hypothesis was proposed, as shown in Table 2.

4. Empirical Research

4.1. Scale Design and Survey Implementation

The questionnaire consists of two parts. The first part is basic information, including demographic variables such as gender, age, online teaching experience, subject background, etc. The online learning experience is determined by college teachers' self-evaluation based on online teaching experience, which is divided into novice type, competent type, and expert

type. The second part is the user experience measurement module. Based on the nine dimensions of the user experience in the theoretical hypothesis model, the items are prepared to reflect the continued use of CX-OTP by college teachers in the intelligent era. The items in the survey scale are based on Likert's 5-level scoring method (very inconformity=1, inconformity=2, general conformity=3, conformity=4, very conformity=5). The research object is college teachers who use the OTP.

To ensure the validity of the measurement items, the researcher invited three experts (including two professors and an associate professor) in the field of information education to evaluate the scientific validity and appropriateness of the scale items. The expert evaluation mainly includes the following two aspects: first, the expression of the initial items, that is, whether there is ambiguity, repetition, incoherence, or incomprehensibility in the expression; second, the validity of the content of the sports school is the degree of the concept of each dimension expressed by the item measurement. The experts evaluate and revise the initial items based on an in-depth understanding of each dimension of the online teaching experience of college teachers. After verification, the invited experts agreed with the overall structure of the items, adjusted the expression of the items appropriately, and finally determined 37 pre-survey items. As shown in Table 3.

Table 3.
Item design.

Variable	Item		References
Online Learning Status of Students	OLSOS1:	Students have independent study space during online teaching activity.	Al-Nuaimi and Al-Emran [7]; Scherer, et al. [8]; Granić and Marangunić [9]; Khong, et al. [33]; Yuan, et al. [34]; Szymkowiak and Jeganathan [35]; Abu Alatta, et al. [36] and Man, et al. [37]
	OLSOS2:	Students are equipped to participate in online teaching activity.	
	OLSOS3:	The students' home environment is in good network condition.	
	OLSOS4:	Students attend online teaching activity regularly.	
	OLSOS5:	Through the online teaching platform, students actively participate in interactive discussions, maintain close contact with teachers and classmates, and complete their coursework on time.	
Online Teaching Investment	OTI1:	Seriously carry out online teaching related knowledge and technical operation.	
	OTI2:	Overcome the difficulties encountered in online teaching actively.	
	OTI3:	Invest a great deal of experience in preparing online teaching resources.	
	OTI4:	Organize rich online interaction activities and reply to students' questions in time.	
	OTI5:	Assign relevant learning tasks to students and check the completion of students' learning tasks in time.	
Online Teaching Experience	OTEx1:	I have organized online teaching activities.	
	OTEx2:	Participated in online learning.	
	OTEx3:	Have certain computer and network operation ability.	
Online Teaching Support	OTS1:	The school organized online instruction.	
	OTS2:	Regularly share and exchange online teaching experience with the course team.	
	OTS3:	Chao Xing Online teaching Platform (CX-OTP) staff can timely and effectively help me solve the technical problems encountered in online teaching.	
Online Teaching Environment	OTEn1:	CX-OTP is convenient for access, running, jump speed, and efficiency; I can conduct online teaching through the Super Star online teaching platform on multiple terminals.	
	OTEn2:	The CX-OTP page layout is appropriate, with good font design, color design, and overall aesthetic appeal. The column settings are reasonable, and the navigation bar settings are clear.	
	OTEn3:	CX-OTP provides course reminders, check-in activities, and other services; it is convenient to upload and download teaching materials, with fast, large network storage capacity. It is also convenient to communicate with students, interact with them, and evaluate each other between teachers and students.	
	OTEn4:	The resource retrieval operation on CX-OTP is simple, and many similar teaching resources can be easily obtained to assist in the development of online teaching activities. Fast retrieval of resources is realized on the premise of ensuring accuracy. The results of resource recommendation and retrieval are comprehensive, reasonable, and highly relevant.	

	OTEn5:	CX-OTP can complete the learning task assignments, homework, course examinations, after-class experiments, course invigilation, and other operations. It records the learning data of students and analyzes the data.	
Perceived Usefulness	PU1:	CX-OTP is helpful for individualized instruction and teaching arrangements for students.	
	PU2:	The teaching resources provided by CX-OTP are updated and iterated quickly, which is suitable for the current course teaching situation and helps me improve my ability to prepare digital teaching resources.	
	PU3:	CX-OTP can better manage teaching, improve the efficiency of classroom management, and help me evaluate the entire learning process of students according to online learning data.	
	PU4:	CX-OTP helps me design online teaching activities, carry out interactive teaching activities, enhance the interaction between me and my students, and improve students' online learning enthusiasm.	
	PU5:	CX-OTP can help me make a comprehensive evaluation by combining students' learning tasks, interactions, test results, and other content. The platform provides students' learning data, and my online teaching evaluation abilities have been improved.	
Perceived Ease of Use	PEOU1:	When conducting online teaching, the network situation is very smooth and easy to operate.	
	PEOU2:	The performance of CX-OTP is very stable.	
	PEOU3:	CX-OTP can present students' online learning data in detail.	
	PEOU4:	The interactive function of CX-OTP is very user-friendly and perfect, and the logical relationships are clear.	
	PEOU5:	The function of CX-OTP can meet my online teaching needs.	
User Experience	UE1:	I enjoy using CX-OTP for online teaching.	
	UE2:	I recommend CX-OTP to my colleagues.	
	UE3:	The CX-OTP is a good product.	
Actual System Use	ASU1:	I really like to use CX-OTP and enjoy the value it brings.	
	ASU2:	Will recommend CX-OTP to others to promote this platform.	
	ASU3:	The same type of OTP, the first thought is CX-OTP.	

The data from two surveys were collected by sending questionnaires through the network. The first was a pre-survey, which was used to test the reliability and validity of the scale and correct it appropriately. The second is a formal survey for confirmatory factor analysis and structural equation model validation.

4.2. Pre-Survey and Project Analysis

The pre-survey targets the teachers at S University, a comprehensive university that implements online teaching, and utilizes the CX-OTP for instruction. It randomly distributes questionnaires to colleagues who are familiar with the process. A total of 31 questionnaires are collected, with 28 deemed valid, resulting in an effective rate of 90%. Among the respondents, men and women are represented equally, as shown in Figure 4.

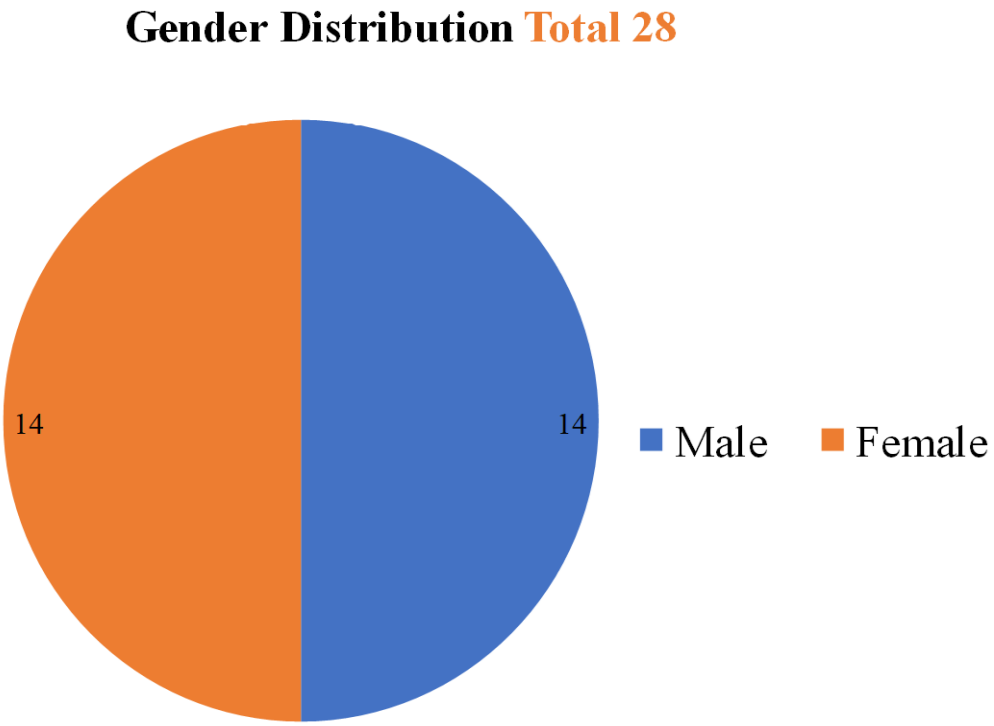

Figure 4.
Pre-survey gender distribution.

Among the tested subjects, the oldest is 53 years old, and the youngest is 26 years old. Among them, 17 teachers are under 35 years old, 11 teachers are over 35 years old, and 10 teachers are between 30 and 34 years old, as shown in Figure 5.

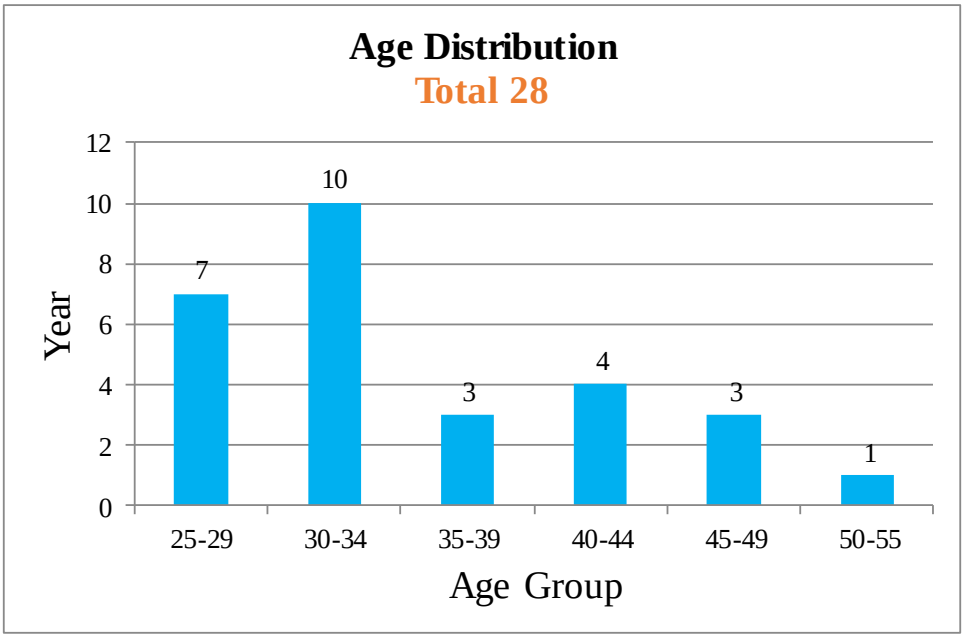

Figure 5.
Pre-survey age distribution.

As the bulk of the population is young, as was previously said, there are 20 teachers with less than ten years of experience in the classroom, eight with more than ten years, and the longest one has thirty years, as can be seen in Figure 6.

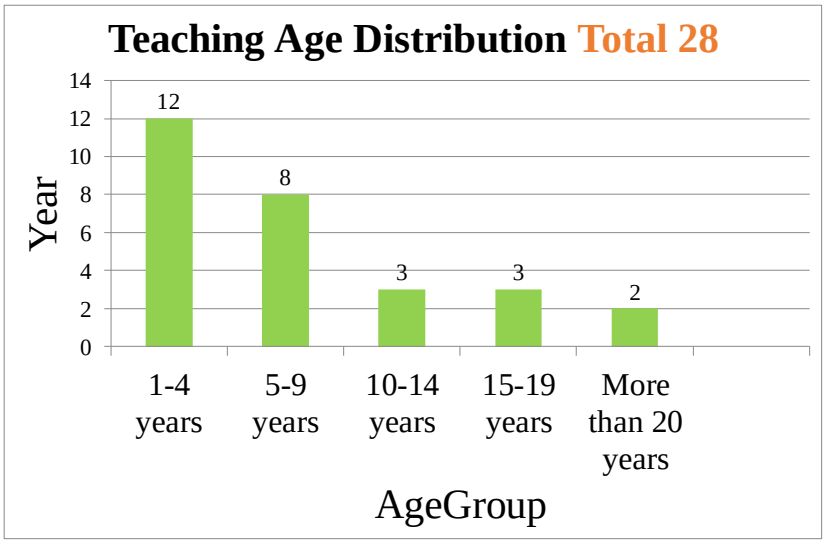

Figure 6.
Pre-survey teaching age distribution.

The subject backgrounds of the teachers include economics, law, literature, engineering, etc., among which the most teachers are from literature backgrounds, with 6 teachers as shown in Figure 7.

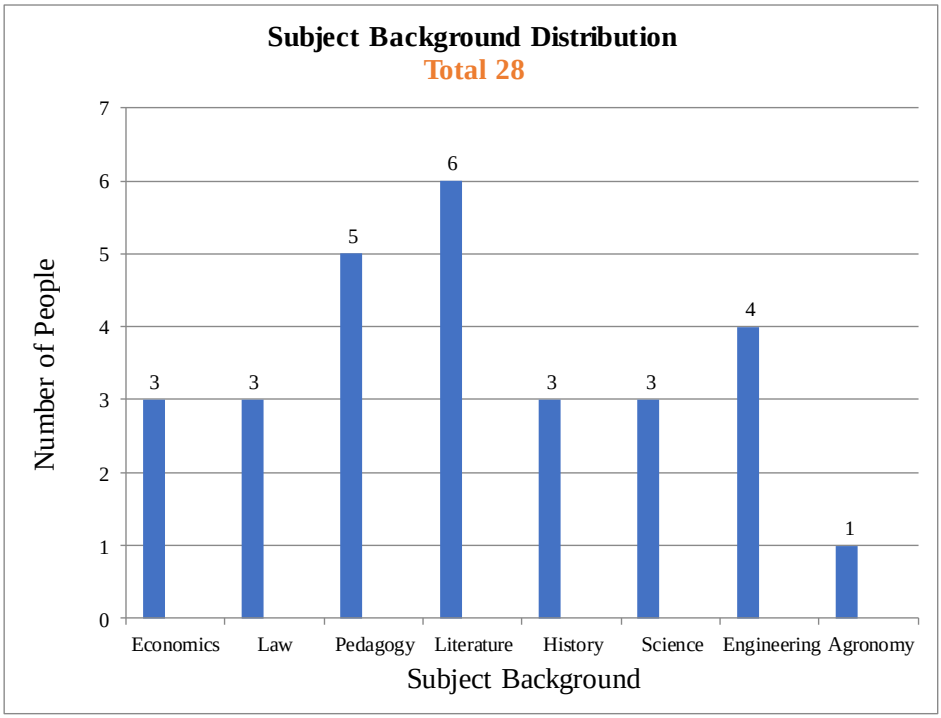

Figure 7.
Pre-survey subject background distribution.

Most of the teachers have online teaching experience, and only 3 have no online teaching experience, as shown in Figure 8.

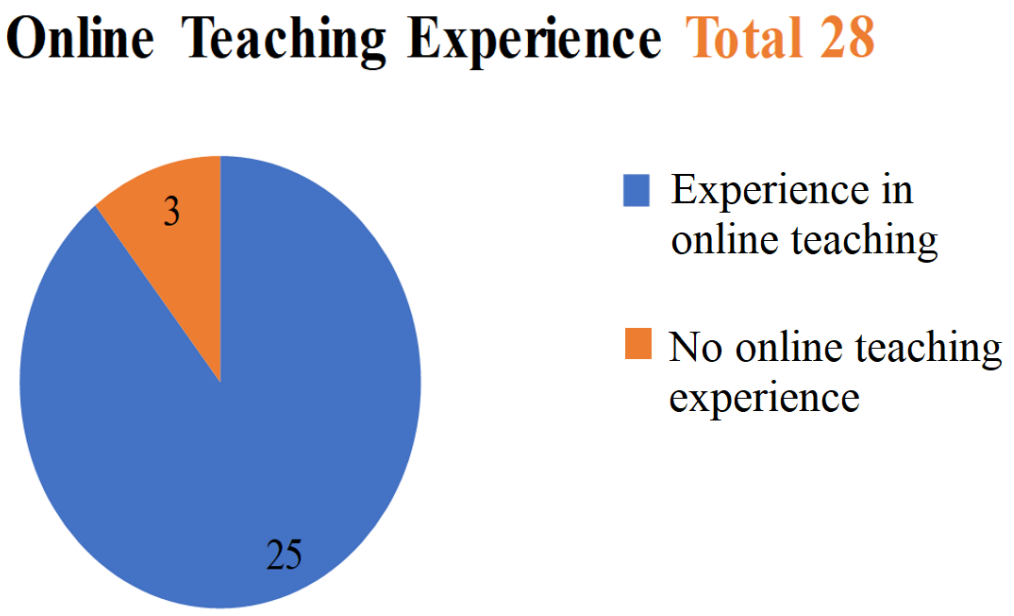

Figure 8.
Pre-survey online teaching experience distribution.

In this pre-survey, young teachers account for the majority. According to the results of the questionnaire, young teachers have a higher user experience with CX-OTP. Because of their longer teaching years and rich teaching experience, older teachers can predict students' online teaching status and devote more time to online teaching than young teachers. Older teachers are accustomed to traditional teaching models, have less computer efficacy, and require more online teaching support.

SPSS 26 was used to analyze the questionnaire data in the pre-survey:

Reliability analysis. In statistics, most scholars use Cronbach's alpha coefficient as a statistical index to test the reliability of the questionnaire. To ensure the reliability and effectiveness of the conclusions, the reliability analysis module of SPSS 26 software was used in this paper to test the reliability of 37 items. After calculation, the Cronbach's value of the whole questionnaire is 0.789 > 0.7; the detailed information is shown in Table 4, indicating that the reliability of the questionnaire is good.

Validity analysis. This paper uses the Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity. Based on statistical research, only when the KMO test coefficient is greater than 0.5 and the P value of Bartlett's Test of Sphericity is less than 0.05 does the questionnaire have structural validity. The pre-survey validity analysis's KMO value is 0.711 > 0.7, and Bartlett's Test of Sphericity result is significant (P < 0.001) at this level. Detailed information reveals that the questionnaire has a good level of structural validity and that its questions can be utilized for evaluation, as shown in Table 5.

Table 4.
Pre-survey combination reliability and reliability test results of each variable.

Dimensionality	Online Learning Status of Students	Online Teaching Investment	Online Teaching Experience	Online Teaching Support	Online Teaching Environment	Perceived Ease of Use	Perceived Usefulness	User Experience	Actual System Use	Whole
Cronbach's a	0.821	0.702	0.715	0.706	0.856	0.712	0.871	0.806	0.91	0.789
Item	5	5	3	3	5	5	5	3	3	37

Note: High Reliability Cronbach's a > 0.8, Good Reliability 0.8 > Cronbach's a > 0.7 , Ordinary 0.7 > Cronbach's a > 0.6 , Dissatisfaction 0.6 > Cronbach's a.

Table 5.
Pre-survey validity test results.

Item	KMO	Bartlett's Test of Sphericity		
		Approximate chi-square	DF	P
Numerical Value	0.711	5428.113	415	0

Note: High Validity KMO > 0.9 , Good Validity 0.9 > KMO > 0.8 , Ordinary 0.8 > KMO > 0.7 , Dissatisfaction 0.7 > KMO.

4.3. Formal-Survey and Project Analysis

This paper excluded the pre-survey sample teachers at the university and then conducted a large-scale random sampling questionnaire survey of the university teachers, with a total of 317 valid questionnaires recovered. The details are shown in the figure.

As can be seen from Figure 9, there are 144 males and 173 females.

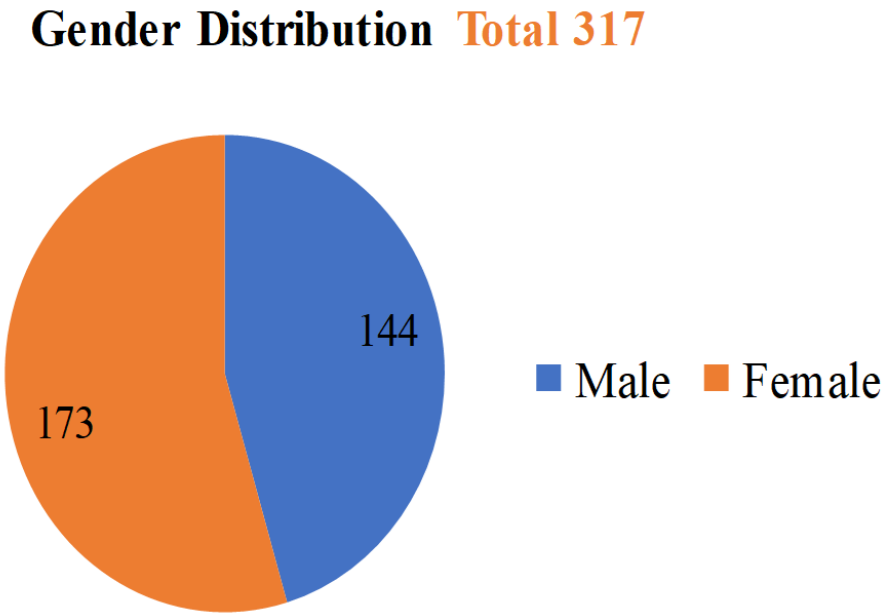

Figure 9.
Formal-survey gender distribution.

From the age distribution in Figure 10, most teachers are still young, with 284 teachers under 40 and only 33 teachers over 40.

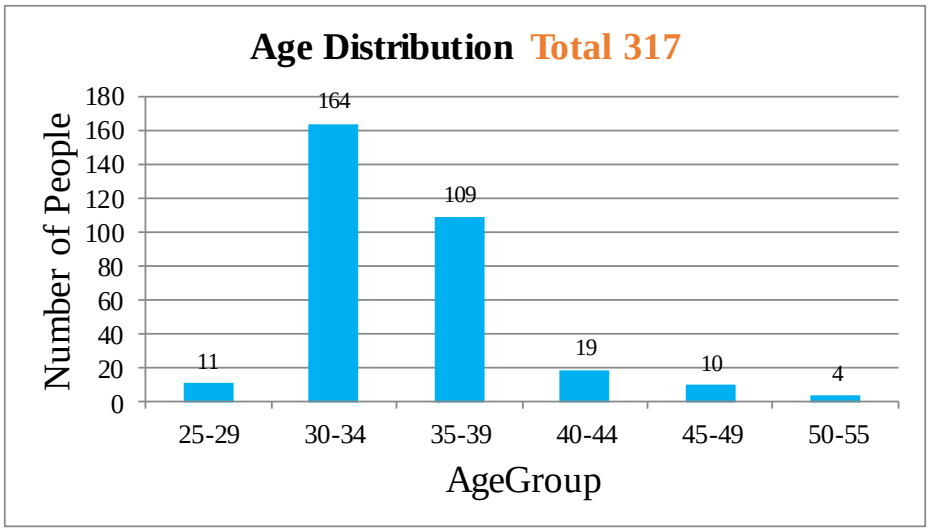

Figure 10.
Formal-survey age distribution.

Among these teachers, 158 teachers have less than 5 years of teaching experience, 265 teachers have less than 10 years of teaching experience, and 52 teachers have more than 10 years of teaching experience, as shown in Figure 11.

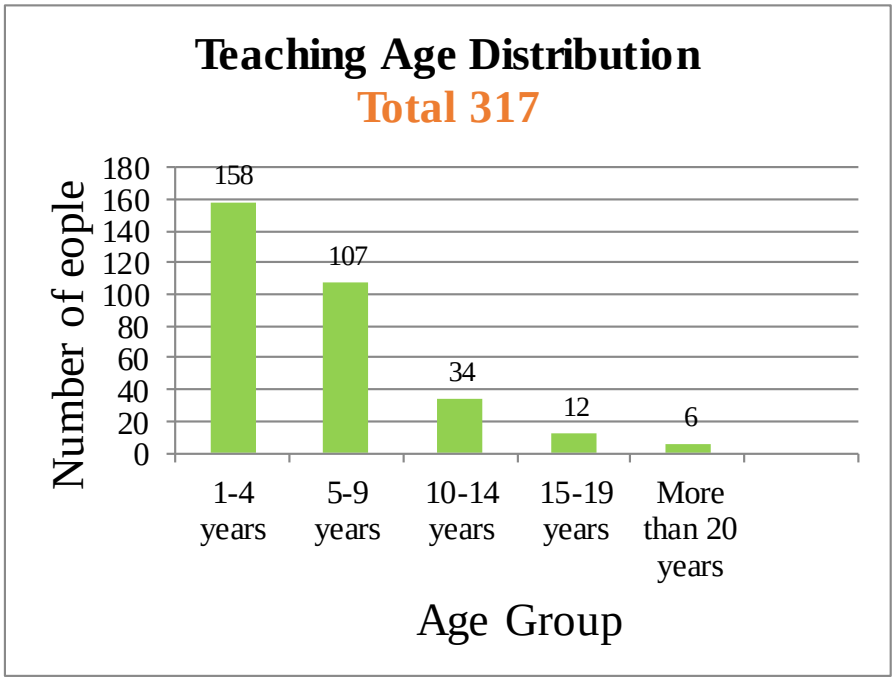

Figure 11.
Formal-survey teaching age distribution.

S University is a comprehensive university, and the subject backgrounds of the interviewed teachers are evenly distributed, with more than 50 teachers with backgrounds in law, literature, and engineering, while the least number in history (only 5), as shown in Figure 12.

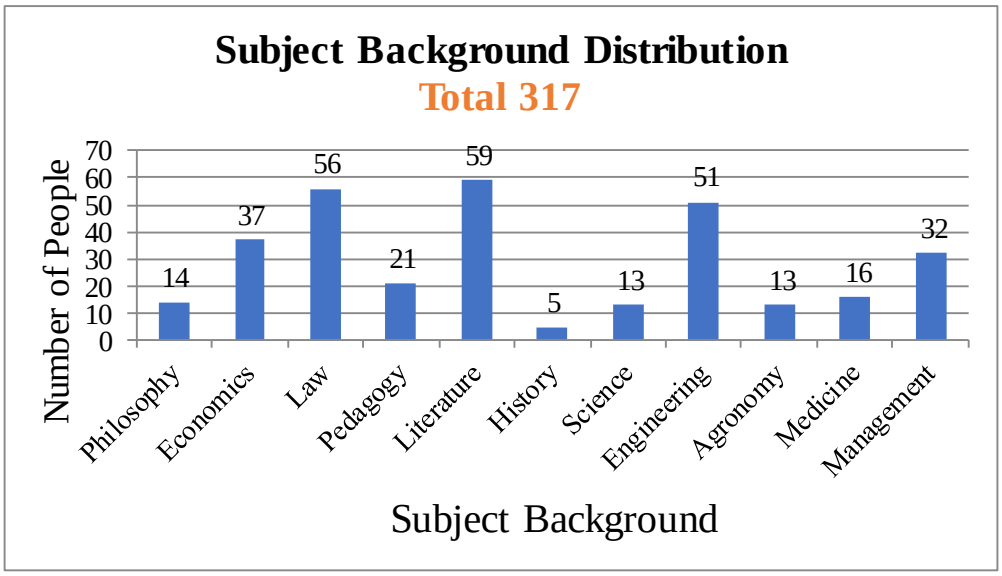

Figure 12.
Formal-survey subject background distribution.

Affected by the epidemic, S University has conducted large-scale online teaching several times in the past three years. Only 19 teachers have no experience in online teaching, while the rest have extensive experience in online teaching, as shown in Figure 13.

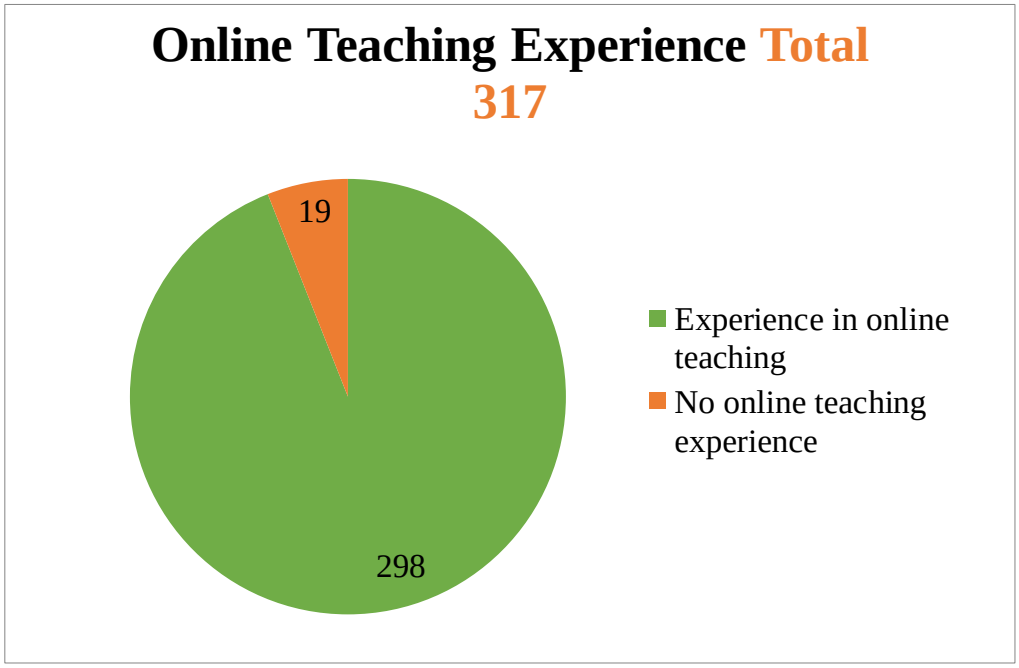

Figure 13.
Formal-survey online teaching experience distribution.

SPSS 26 software was also used for reliability analysis of the formal-survey, and the results show that the Cronbach's a value of the questionnaire is 0.686, as shown in Table 6, indicating that it has good internal consistency.
KMO value was 0.70, and Bartlett's Test of Sphericity results reached a significant level ($P < 0.001$), as shown in Table 7. The results of further confirmatory factor analysis show that the user experience items can effectively reflect the measured variables, and the factor load of each item is greater than 0.7 ($P < 0.05$). CR represents composite reliability, and the composite reliability value is greater than 0.6. AVE represents average variance extracted, and the value is greater than 0.5; those values indicate reliability and validity. In this paper, the overall reliability and validity level is relatively ideal, as shown in Table 8.

Table 6.
Formal-survey combination reliability and reliability test results of each variable.

Dimensionality	Online Learning Status of Students	Online Teaching Investment	Online Teaching Experience	Online Teaching Support	Online Teaching Environment	Perceived Ease of Use	Perceived Usefulness	User Experience	Actual System Use	Whol
Cronbach's a	0.745	0.638	0.613	0.638	0.705	0.612	0.695	0.742	0.783	0.686
Item	5	5	3	3	5	5	5	3	3	37

Note: High Reliability Cronbach's a > 0.8, Good Reliability 0.8 > Cronbach's a > 0.7 , Ordinary 0.7 > Cronbach's a > 0.6 , Dissatisfaction 0.6 > Cronbach's a.

Table 7.
Formal-survey validity test results.

Item	KMO	Bartlett's Test of Sphericity		
		Approximate chi-square	DF	P
Numerical Value	0.70	5113.283	405	0

Note: High Validity KMO > 0.9, Good Validity 0.9 > KMO > 0.8 , Ordinary 0.8 > KMO > 0.7 , Dissatisfaction 0.7 > KMO.

Table 8.
Confirmatory Factor Analysis (CFA).

Factors		Variables	Estimate	CR	AVE
ASU1	<---	ASU	0.87	0.83	0.621
ASU2	<---	ASU	0.745		
ASU3	<---	ASU	0.743		
OLSOS1	<---	OLSOS	0.786	0.881	0.598
OLSOS2	<---	OLSOS	0.796		
OLSOS3	<---	OLSOS	0.87		
OLSOS4	<---	OLSOS	0.725		
OLSOS5	<---	OLSOS	0.703		
OTEn1	<---	OTEn	0.712	0.806	0.516
OTEn2	<---	OTEn	0.733		
OTEn3	<---	OTEn	0.726		
OTEn4	<---	OTEn	0.701		
OTEn5	<---	OTEn	0.722		
OTEx1	<---	OTEx	0.707	0.76	0.543
OTEx2	<---	OTEx	0.833		
OTEx3	<---	OTEx	0.899		
OTI1	<---	OTI	0.73	0.88	0.597
OTI2	<---	OTI	0.696		
OTI3	<---	OTI	0.849		
OTI4	<---	OTI	0.895		
OTI5	<---	OTI	0.723		
OTS1	<---	OTS	0.853	0.874	0.7
OTS2	<---	OTS	0.919		
OTS3	<---	OTS	0.727		
PEOU1	<---	PEOU	0.794	0.933	0.738
PEOU2	<---	PEOU	0.951		
PEOU3	<---	PEOU	0.901		
PEOU4	<---	PEOU	0.831		
PEOU5	<---	PEOU	0.808		
PU1	<---	PU	0.701	0.669	0.501
PU2	<---	PU	0.743		
PU3	<---	PU	0.712		
PU4	<---	PU	0.781		
PU5	<---	PU	0.831		
UE1	<---	UE	0.841	0.791	0.56
UE2	<---	UE	0.839		
UE3	<---	UE	0.708		

Note: Factor Load > 0.7 CR > 0.6 CVE > 0.5 t is considered to have good reliability and validity.

Table 9.
The fitting results of structural equation models.

Model fit index	Ideal Standard	General standard	Fitting result	Conclusion
CMIN/DF	1~3	<10	2.358	General fit
RMSEA	<0.08	<0.1	0.093	General fit
CFI	>0.9	>0.8	0.858	General fit
IFI	>0.9	>0.8	0.859	General fit
NFI	>0.9	>0.8	0.809	General fit
TLI	>0.9	>0.8	0.834	General fit

According to Table 9, All concordant indicators are satisfactory, demonstrating the questionnaire's strong structural validity. The questionnaire's dependability is generally good and can accurately assess college professors' online learning experiences.

4.4. Structural Equation Model Analysis

AMOS 24.0 software was used to estimate the path coefficients of the constructed sample model according to the maximum likelihood method, involving nine variables. The nine variable values contain 37 measurement indicators. Figure 14 illustrates the structural equation model.

The relevance of the path coefficients will then be determined. The association is unsupportable when the C.R. absolute value is less than 1.96 and the P value is higher than 0.05. The association between online teaching experience and perceived ease of use path was not significant, according to the model's final path coefficient table. We made the decision to eliminate this approach after considering the analysis of the real circumstances and the fundamental model. The fit degree index of the model was CMIN/DF = 2.358 and RMSEA = 0.078. Therefore, the fitting state of the model is up to standard.

The results of the standardized regression coefficient (β), standard error (S.E.), critical ratio (C.R), significance level (P), and hypothesis testing are shown in Table 10.

The final structural equation model is depicted in Figure 15 and all path coefficients after modification are significant, as can be observed from the aforementioned path coefficient test findings.

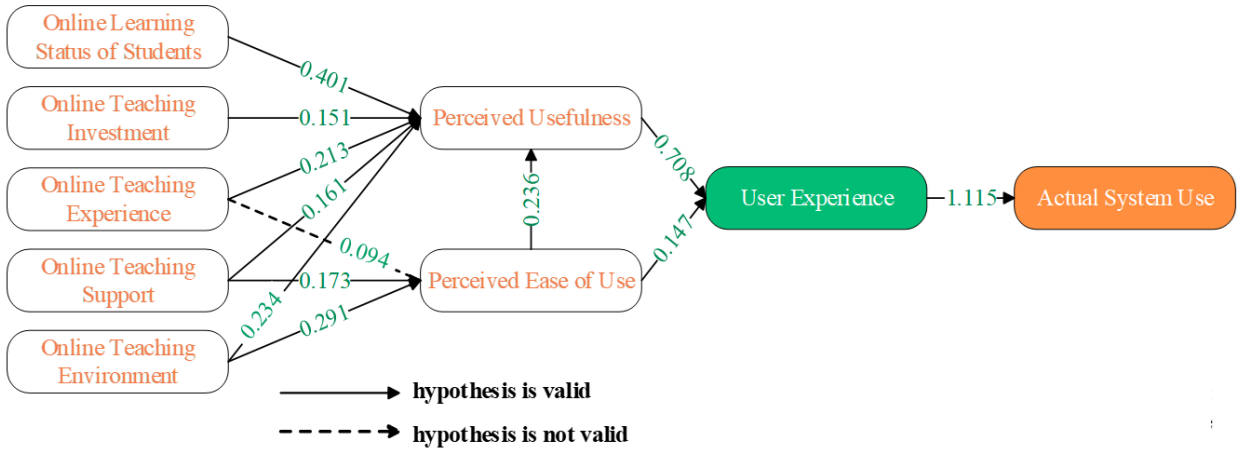

Figure 14.
Structural equation model.
Noted: The number on the solid line represents a significant impact coefficient, and the symbol on the dotted line represents the hypothesis number that does not hold.

Table 10.
Test values of model path parameters and verification of research hypotheses.

Hypothesis	Path	β	S.E.	C.R.	P	Hypothetical judgment
H1	Online Learning Status of Students' perceived Usefulness	0.415	0.048	8.587	***	Significant
H2	Online Teaching Investment Perceived Usefulness	0.152	0.085	2.993	**	Significant
H3	Online Teaching Experience Perceived Usefulness	0.223	0.082	4.732	***	Significant
H4-1	Online Teaching Support Perceived Usefulness	0.163	0.027	3.942	***	Significant
H4-2	Online Teaching Support Perceived Ease of Use	0.179	0.061	4.337	***	Significant
H5-1	Online Teaching Environment Perceived Usefulness	0.244	0.119	5.045	***	Significant
H5-2	Online Teaching Environment Perceived Ease of Use	0.301	0.118	6.546	***	Significant
H6	Perceived Ease of Use perceived Usefulness	0.237	0.031	4.55	***	Significant
H7	Perceived Usefulness user Experience	0.713	0.103	8.898	***	Significant
H8	Perceived Ease of Use user Experience	0.151	0.057	2.897	**	Significant
H9	User Experience actual System Use	1.115	0.09	14.327	***	Significant

Note: *** indicates P<0.001 ** indicates P<0.01 * indicates P<0.05.

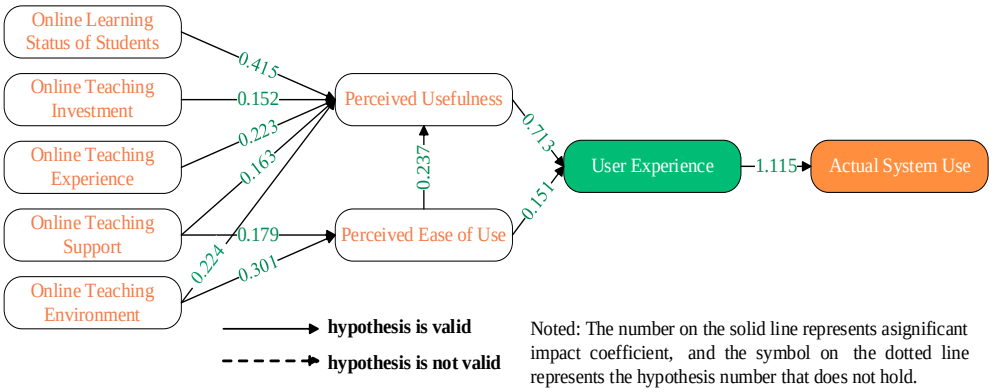

Figure 15.
Modified structural equation model.

5. Results

According to the results of the formal survey, all 317 teachers who received the questionnaire survey are using online teaching. Except 19 teachers who have no online teaching experience, the rest of the teachers, subject background, age, experience, etc. will not hinder their organization of online teaching.

Through literature reading, the indicator variables of user experience are defined as follows: Online Learning Status of Students (OLSOS), Online Teaching Investment (OTI), Online Teaching Experience (OTEx), Online Teaching Support (OTS), Online Teaching Environment (OTEn), Perceived Usefulness (PU), Perceived Ease of Use (PEOU), User Experience (UE), Actual System Use (ASU). Based on the TAM model, a user experience model was constructed from the above 9 variables and 12 hypotheses were formed, while 37 question items were generated from the 9 variables to form a questionnaire. In the formal survey, Cronbach's a=0.686, KMO=0.70 (P<0.001), and the reliability and validity of the questionnaire were good. The five-point Likert scale method was used to collect user experience. Structural equation model was used to analyze the hypothesis, and the β=0.094, P>0.05 hypothesis of H3-2 was not significant. Therefore, this hypothesis was removed and the model was modified, and the path coefficients after correction were all significant.

The resulting structural equation model allows for the following inferences. The primary external variable affecting perceived usefulness is students' online learning status, in other words, H1, standardized regression coefficient β=0.415, standard error S.E.=0.048, critical ratio C.R.=8.587, significance level P<0.001, satisfying C.R. conditions with absolute value greater than 1.96 and P<0.05. Which indicates that the perceived usefulness psychology of college teachers' online teaching is mainly satisfied by students' learning status and mastery of knowledge. It also shows that the primary motivation for college teachers to use online teaching platform is that students can master the professional knowledge and skills taught by teachers through CX-OTP. The psychological influence of online teaching experience and online teaching environment on the perceived usefulness of college teachers is greater than that of online teaching input and online teaching support.

Assume that in H4-2 and H5-2, through perceived ease of use, online teaching environments and support can influence user experience and encourage users to use the online teaching platform. Online teaching support has little impact on college teachers' reported ease of use and usefulness, the result of OTS->PEOU is β=0.0.179, S.E.=0.061, C.R.=4.337, P<0.001. The hypothesis holds significantly, with the psychological impact of an online teaching environment being bigger than the perceived usefulness, the result of OTEn->PEOU β=0.3.1, S.E.=0.118, C.R.=6.546, P<0.001.

Assume that in H7 and H8, the model shows that user experience directly influences the system's actual use intention, perceived usefulness is the key factor influencing user experience, the result of PU->UE is β=0.713, S.E.=0.103, C.R.=8.898, P<0.001, and perceived usefulness has a substantially higher influence coefficient on user experience than perceived ease of use, PEOU->UE just β=0.151, p<0.01.

Moreover, PEOU->PU->UE and PEOU->UE, the influence coefficient of perceived usability on the user experience through perceived usefulness is greater than that of perceived usability directly on user experience. This means that college teachers are looking forward to the useful teaching effect when implementing online teaching through the superstar online teaching platform.

6. Conclusions

Artificial intelligence technology has been gradually applied to various OTP. This paper takes the diagnosis of the UE of college teachers in online teaching as the starting point. Based on the user perspective, combined with the situation of students, teachers, technical characteristics, and service characteristics of the platform, it constructs CT-OTUEM. The usability of this model is further verified by practical application.

The user experience model of teachers' online teaching was constructed based on the TAM model. At the same time, the user experience data of teachers using the Chaoxing online teaching platform was collected at S University by means of a questionnaire. Internal factors are composed of perceived usefulness and perceived ease of use that jointly affect user experience, and then the actual use of the system. The model was tested by structural equation modeling, and the final user experience model of teachers' online teaching was obtained by modifying the assumption path. Perceived usefulness is a key factor in user experience, and user stickiness can be enhanced through this link. Value specification of online teaching for teachers is discussed. This paper contains the basic value orientation of online teaching. Each index reflects the course value,

technology value, and service value of online teaching. It provides the basis for standardizing online teaching, enhancing teachers' sense of teaching achievement, further perceiving usefulness, and ensuring the healthy and sustainable development of online teaching.

Although the subjective evaluation method was adopted in this paper to highlight the importance of user experience in platform development, the evaluation subject was too simple, the sample was limited to teachers in universities, and the regional characteristics failed to be highlighted. Only one platform was selected, and the user experience of other OTP was not compared. The analysis of platform multi-agent, or subject to multi-platform, multi-data can increase the scientific evaluation. With the development of big data technology, the function of OTP data collection and processing is becoming more and more powerful. The follow-up research needs to increase the multi-agent and multi-platform research to achieve more objective and scientific research results on user experience.

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