# The Impact of Online Live Teaching Platform Quality on College Students' Learning Ability: The Chain Mediating Effect of Knowledge Sharing and Satisfaction Postprint

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**Date:** 2023-04-01T16:02:46+00:00

## Abstract

[Purpose/Significance] This study investigates the influence of online live teaching platform quality on university students' learning ability and its underlying mechanisms, aiming to provide references for research on online live teaching in higher education institutions. [Methodology/Process] Based on the characteristics of online live teaching, using the Information System Success Model as the framework, and with knowledge sharing and satisfaction as chain mediators, a model of the influence of online live teaching platform quality on university students' learning ability was constructed. A questionnaire survey was administered to 578 university students, and the collected data were analyzed. [Results/Conclusions] Platform system quality and service quality have direct, significant positive effects on university students' learning ability. Platform resource quality and functional quality have no significant direct effect on university students' learning ability, but their indirect effects are significant. Knowledge sharing and satisfaction jointly play a partial mediating role between platform system quality, service quality and university students' learning ability. Knowledge sharing and satisfaction jointly play a fully mediating role between platform functional quality, resource quality and university students' learning ability.

## Full Text

## Preamble

**A Study on the Impact of Live Online Teaching Platform Quality on University Students' Learning Ability—The Chain-Mediating Effects of Knowledge Sharing and Satisfaction**

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**Abstract:** [Purpose/Significance] This study explores the impact of live online teaching platform quality on university students' learning ability and its underlying mechanisms, aiming to provide references for research on live online teaching in higher education. [Method/Process] Based on the characteristics of live online teaching and using the Information System Success Model as a framework, this study constructs a model examining how platform quality influences student learning ability with knowledge sharing and satisfaction as chain mediators. A questionnaire survey was administered to 578 university students, and the collected data were analyzed. [Result/Conclusion] The platform's system quality and service quality have direct, significant positive effects on student learning ability. While the direct effects of resource quality and functional quality on learning ability are not significant, their indirect effects are significant. Knowledge sharing and satisfaction together play a partial mediating role between system quality, service quality and learning ability, and a complete mediating role between functional quality, resource quality and learning ability.

**Keywords:** Information System Success Model; live online teaching platform; learning ability; knowledge sharing; satisfaction; chain mediating effect

**Classification Numbers:** G434; G203
**DOI:** 10.13266/j.issn.0252-3116.2021.04.007

The outbreak of COVID-19 disrupted normal offline teaching in Chinese universities during the 2020 spring semester. To minimize the pandemic's negative impact on university operations and ensure normal educational order, the Ministry of Education issued guidelines on organizing and managing online teaching during the epidemic prevention and control period, requiring universities to actively conduct online teaching and learning activities through various online course platforms and learning spaces to guarantee teaching progress and quality [1]. This has become a key focus in current educational research.

This study examines the actual implementation of online teaching under COVID-19, using the Information System Success Model as the basic framework with knowledge sharing and satisfaction as chain mediators. Through structural equation modeling, it analyzes how live online teaching platform quality affects university students' learning ability, aiming to provide recommendations for live online teaching practices.

## 2. Characteristics of New Live Online Teaching Platforms

Faced with the sudden outbreak of COVID-19, Chinese universities balanced epidemic prevention with educational work, fully utilizing "Internet + Education" functions for online instruction to address teaching challenges during the pandemic. The scale of live online courses during this period reached historic

levels, opening a new chapter in higher education teaching methods. Many new issues emerged in live online teaching activities, with teachers exploring and advancing through practice. Therefore, timely research and summarization of successful experiences, as well as identification of defects and deficiencies, are crucial current priorities.

### 2.1 Students at the Core of Teaching

In traditional online teaching, students primarily selected courses and teachers based on personal preferences and learning needs. While this effectively completed standardized teaching requirements and processes, it represented a "stimulus-response" based teaching form that was formulaic and singular, making it difficult to construct a classified and layered teaching system according to different student types. The emergence of new live online teaching platforms has placed students at the core of teaching activities, with teachers paying greater attention to student needs and feedback. Simultaneously, bidirectional live teaching enhances the advantages of customized learning, allowing teachers to grasp student dynamics in real-time during live sessions based on immediate reactions. Student experiences and feedback on live teaching also facilitate teaching model innovation and improvement.

### 2.2 Transition from One-Way to Bidirectional Shared Interactive Learning, Enhancing Student Autonomy

Shared interactive learning refers to the collaborative relationship formed between instructors and learners, and among learners themselves, through various means and methods during the teaching process [3]. Distributed cognition theory emphasizes interaction in cognitive activities, and internet development provides students with more complete communication platforms and technical support, making interaction more convenient and efficient [4]. In traditional MOOC teaching, many instructors recorded courses for online instruction, with students learning content through network media to complete learning tasks. The biggest drawback was the inability to facilitate knowledge exchange and interaction between teachers and students or among students themselves, failing to replace classroom teaching based on bidirectional communication. New live online teaching platforms utilize mobile real-time audio-video technology to achieve bidirectional instant communication and knowledge sharing between teachers and students, maximizing the restoration of face-to-face participation. This "audio-visual combination + interactive sharing" model represents an optimized knowledge acquisition approach that helps improve student learning ability. Students can also collaborate and exchange knowledge according to their needs, enhancing the flexibility and interactivity of online teaching to achieve true online education.

### 2.3 Breaking Time and Space Constraints, Expanding Teaching Coverage

Live online teaching offers greater freedom in time and space. Regardless of who the learners are or where they are located, they can participate in live online learning through computers, mobile phones, and other devices via the internet, interact with teachers in live classrooms, and access open and shared educational resources. Meanwhile, the evolution from offline teaching to online teaching and then to live online teaching demonstrates how network technology has promoted progress and innovation in China's education models, optimizing and improving the education system [5].

### 2.4 More Rational Platform Function Configuration, Achieving Effective Utilization of Teaching Resources

Live online teaching platforms are equipped with functions such as sign-in, mic connection, quizzes, exams, and feedback based on live teaching needs, providing systematic teaching services including learning, testing, examination, and evaluation to improve student learning efficiency. When student users can raise their own questions during communication according to their situations, it helps cultivate autonomous learning ability. Live online teaching can effectively utilize high-quality online teaching and knowledge resources, including not only hardware and software equipment supporting teaching but also professional expert resources and disciplinary knowledge resources. After class, students can review live recordings and consult relevant disciplinary information resources on the platform to fill gaps, making knowledge more solid and continuously improving learning ability. In live online teaching interactions, teachers can adjust teaching content according to student needs and teaching objectives, solve problems instantly, and optimize teaching processes [2]. Overall, compared with traditional network teaching platforms, live online teaching platforms present new characteristics in function, resources, and system, enhancing students' autonomous learning ability through knowledge sharing.

## 3. Theoretical Foundation and Literature Review

### 3.1 Information System Success Model

The Information System Success Model (DeLone and McLean Model of IS Success, D&M Model) was proposed by W. H. DeLone and E. R. McLean in 1992 and optimized in 2003 to construct a new D&M Model [6]. The new D&M Model primarily examines information systems through the pathways where information quality, system quality, and service quality influence usage intention and user satisfaction, thereby affecting net benefits, as shown in Figure 1 [Figure 1: see original paper]. Currently, the D&M Model has been widely applied to evaluate information system success [7]. G. W. Bock et al. used system usage instead of net benefits as a measure of system success when analyzing factors influencing organizational knowledge base systems from a sharing

perspective [8]. V. Kisekka used the D&M Model to study the effectiveness of health information exchange, noting that information security effectiveness also increases patients' positive attitudes toward health information exchange [9]. R. Nulhusna et al. placed trust within the information system success model to analyze public continuous usage intention and online word-of-mouth when examining public participation factors in e-government systems [10]. Xie Jialin et al. added a regret variable to the D&M Model to study how library annotation system quality affects user annotation behavior in university libraries [11].

System quality evaluates information systems from a user perspective through technology and design, including access convenience, response time, user-friendliness, reliability, stability, and system speed [12]. Information quality primarily refers to the content quality produced by information systems, measuring semantic success [13], namely information relevance, accuracy, timeliness, and completeness [14]. Information provided in live online teaching platforms mostly concerns teaching and disciplinary knowledge, so in this information system context, defining information quality as resource quality is more effective. Service quality refers to users' evaluation of services obtained from information systems, including service responsiveness, accuracy, and technical capability. Satisfaction refers to "the impact after users actually use the information system" [15]. Usage intention refers to users' actual behavioral evaluation of using information systems. Since live online teaching is mandatory learning replacing offline courses, this variable is less prominent in live online teaching platforms and thus not considered in this study. The key to remote learning is knowledge sharing, which can be viewed as a form of information system usage behavior. Net benefits mainly refer to users' evaluation of benefits obtained from using information systems. This study empirically analyzes the close connection between live online teaching platform systems and university students' learning ability, where improved learning ability after using live teaching platforms represents "net benefits."

### 3.2 Knowledge Sharing

Ikujiro Nonaka, the father of knowledge creation theory, defined knowledge sharing from a knowledge innovation perspective as the interactive process between individuals and organizations regarding explicit and tacit knowledge through externalization, internalization, combination, and socialization within organizations [16]. Y. Charband et al. considered knowledge sharing as activities where people, friends, and organizations exchange knowledge, information, skills, or expertise [17]. Thus, knowledge sharing has dynamic characteristics requiring communication and exchange among various actors. K. Dalkir noted that the selection of knowledge sharing channels can use ICT selection methods based on media richness and social presence [18]. S. W. Hung et al. found that perceived ease of use and perceived usefulness can promote knowledge sharing willingness among virtual community users, with perceived ease of use indirectly affecting knowledge sharing intention through perceived usefulness [19]. Hu Lewei et al.,

based on contingency theory, studied the mediating effect of knowledge sharing capability between IT integration and competitive performance, as well as the moderating roles of relationship governance and environmental turbulence [20].

In the knowledge and information society, e-learning is built on the extensive use of advanced information and communication technologies, providing knowledge users with greater flexibility to learn at different times and locations [21]. Knowledge sharing involves establishing networks with other experts for face-to-face communication or recording, organizing, and capturing knowledge for others [22]. Knowledge sharing in live online teaching includes two levels: Knowledge transfer between teachers and students in live online teaching, such as students asking questions and teachers providing answers, or teachers imparting knowledge through online instruction. Knowledge sharing among students, where teachers assign learning tasks and students communicate and collaborate; students can also share knowledge they have learned with other classmates. This knowledge sharing represents the application of Nonaka's knowledge socialization, externalization, combination, and internalization. Personal connections in social networks can also promote knowledge transfer and improve the quality of received information [23]. As described above, the subjects of knowledge sharing in live online teaching are teachers and students. Teachers organize instruction, release learning objectives, monitor student behavior, guide student learning, and evaluate learning outcomes, while students participate in knowledge exchange and evaluate teaching effectiveness. Every member in live teaching is both a knowledge transmitter and receiver.

## 4. Research Hypotheses and Model Construction

### 4.1 Research Hypotheses

**4.1.1 Live Online Teaching Platform Quality and Student Learning Ability** The information system platform for online knowledge sharing and interactive communication between teachers and students is the soul of online learning. Based on the three factors of system quality, resource quality, and service quality from the Information System Success Model, combined with the characteristics of live online teaching platforms, this study constructs a functional quality factor to reflect live online teaching platform quality through these four factors.

Online learning ability represents students' overall response during course learning. Current research suggests that information systems affect learners' online learning performance and outcomes. For example, R. T. Sparrowe et al. noted that social networks directly affect final grades [24], while Tang Chengkun et al. found that social media as a collaborative learning tool positively promotes learning effectiveness [25]. Live online teaching is a special type of online learning community, and Zhong Keding et al. believed that educational and technical factors in online learning community structures can effectively improve remote learners' academic performance [26].

Live online teaching differs from previous classroom and online teaching by placing students in a dominant position, emphasizing autonomous learning ability and sharing willingness, and enhancing problem-solving skills. System quality significantly impacts information system success [6]. If users need to wait too long to access live online teaching platforms, experience difficulty quickly loading interfaces, or encounter unsmooth usage, these factors affect student experience and reduce trust in the platform. Live teaching platforms need continuous updates to fix system vulnerabilities, improve system smoothness, and enhance data security to help students complete autonomous learning on the platform. Live online teaching platforms face users from many majors with diverse resource needs. Therefore, platforms must provide high-quality disciplinary information resources to effectively guarantee student learning value. When platforms promptly respond to student problems during usage and provide effective solutions, and offer targeted services based on user information and teaching support, they improve student usage levels and enhance learning ability. Live online teaching platforms configure diverse functions based on live teaching needs to serve teaching and improve student learning efficiency while cultivating autonomous learning ability. Based on this, this study proposes:

H1a: Live online teaching platform system quality positively affects university student learning ability.
H1b: Live online teaching platform service quality positively affects university student learning ability.
H1c: Live online teaching platform resource quality positively affects university student learning ability.
H1d: Live online teaching platform functional quality positively affects university student learning ability.

**4.1.2 The Mediating Role of Knowledge Sharing** Distributed cognition theory states that cognitive phenomena include processes where people achieve certain activities through interaction, manifested in live teaching platforms as knowledge exchange between teachers and students and among students themselves. Information technology promotes learning ability, but relying solely on information technology cannot effectively promote knowledge learning. Due to the distributed nature of knowledge, individuals can carry limited knowledge, but team knowledge is infinite, highlighting the importance of knowledge sharing among people [27]. U. Cress et al. noted that in network environments, knowledge owners and knowledge demanders cannot conduct face-to-face communication and need to construct a shared database to facilitate group knowledge exchange and promote user sharing behavior [28]. Building knowledge sharing networks through online teaching platforms allows users to use fragmented time for autonomous learning, enhancing learning performance [29]. Knowledge sharing significantly affects interaction throughout the platform usage process and is a way to improve learning outcomes [30]. However, knowledge sharing activities as social exchange behaviors are influenced by information technology, knowledge subjects, and other aspects [31].

The characteristics of network interaction are fully applied on live platforms. With information technology means, live online teaching platforms better align with student interests, allowing teachers and students to conduct online communication, knowledge sharing, and learning experience exchange as internet hosts, thereby enhancing learning ability. In online teaching, teachers guide students by organizing online teaching activities and integrating online resources, stimulating student enthusiasm for autonomous learning through online classroom and collaborative activities. Teachers cannot simply present teaching content but must make student-knowledge resource interaction the core content [32]. As a new and humanized online education product, live online teaching platforms emphasize privacy protection during usage and knowledge sharing settings between teachers and students and among students. In online learning, the communication environment among members is more open than offline courses, providing stronger psychological security, thus giving them more courage to express genuine thoughts and ideas. Different knowledge collisions facilitate knowledge sharing. The knowledge sharing process requires individuals to exchange and communicate information, such as learning group members in online teaching who actively communicate, interact, and learn equally through feedback, questions, and answers, actively promoting knowledge sharing and driving knowledge development [33]. However, knowledge sharing behavior includes not only knowledge seekers' knowledge-seeking behavior but also knowledge providers' knowledge transmission and teaching behavior [34]. Therefore, in online teaching, teachers imparting knowledge to students and enhancing their learning ability is also knowledge sharing behavior. Through knowledge openness and flow, users can achieve knowledge sharing and improve autonomous learning ability in the systematic process of knowledge transfer, utilization, and feedback. Live online teaching classrooms are similar to offline teaching, taking a class group as the unit. Individuals who like group work are more likely to interact and share information frequently. This student cooperative learning-centered online teaching helps cultivate students' autonomous learning, communication, and expression abilities. Based on this, this study proposes:

H2a: Knowledge sharing mediates the relationship between live online teaching platform system quality and university student learning ability.
H2b: Knowledge sharing mediates the relationship between live online teaching platform service quality and university student learning ability.
H2c: Knowledge sharing mediates the relationship between live online teaching platform resource quality and university student learning ability.
H2d: Knowledge sharing mediates the relationship between live online teaching platform functional quality and university student learning ability.

**4.1.3 The Mediating Role of Satisfaction** According to the D&M Model, system quality, information quality, and service quality affect user satisfaction during information system usage [35]. T. P. Dong [36] and S. Park [37] found that information quality and system quality have significant positive effects on user satisfaction. H. Alali et al. proposed that service quality has a significant

positive impact on health forum users' satisfaction evaluation [38]. Additionally, numerous studies have proven that system quality, information quality, and service quality positively affect user satisfaction in online learning contexts [39-41].

User satisfaction with online courses correlates with final grades [42]. Live online teaching platform satisfaction represents students' systematic evaluation after perceiving platform features and forms their emotional responses and psychological feelings from long-term platform usage experience. Learning ability represents students' knowledge capability, quality capability, and behavioral capability. According to behavior motivation theory and incentive theory, individual attitudes determine behavior. Students' satisfaction with live online teaching platforms determines their knowledge learning behavior and outcomes. Teaching live platforms satisfying students' emotional consciousness can enhance student usage satisfaction by optimizing and updating platform system quality, resource quality, information quality, and functional quality, effectively promoting learning willingness and enthusiasm, enabling students to invest more energy in knowledge learning, and thereby enhancing learning effectiveness. Therefore, when students are satisfied with live online teaching platform quality, they are more likely to stimulate online learning interest, strengthen understanding of course theoretical knowledge, and improve learning ability. Based on this, this study proposes:

H3a: Satisfaction mediates the relationship between live online teaching platform system quality and university student learning ability.
H3b: Satisfaction mediates the relationship between live online teaching platform service quality and university student learning ability.
H3c: Satisfaction mediates the relationship between live online teaching platform resource quality and university student learning ability.
H3d: Satisfaction mediates the relationship between live online teaching platform functional quality and university student learning ability.

**4.1.4 The Chain-Mediating Role of Satisfaction and Knowledge Sharing** In live online teaching, students' perceived value of live online teaching platforms is essentially their perceived evaluation of system quality, service quality, functional quality, etc. Typically, evaluation results of internet platforms affect whether users continue using them, with satisfaction often serving as a mediator variable for judging user behavioral intention. J. J. Cronin et al. noted that service quality, service value, and satisfaction positively promote behavioral intention [43]. L. Ho et al. found that internet technology quality and users' attitudes toward computer use positively affect knowledge sharing [44].

According to expectation-confirmation theory, user satisfaction affects continuous usage intention [15]. From a knowledge sharing perspective, user satisfaction affects their decision to continue knowledge sharing [45]. For online knowledge communities, the higher users' overall evaluation and satisfaction with the com-

munity, the more willing they are to fully share knowledge with other users to participate in community activities [46]. C. M. Cheung et al. believed that when members find they receive expected reciprocity, they feel satisfied, which further affects their intention to continue sharing knowledge in online communities of practice [47]. According to social exchange theory, all human behaviors are governed by exchange activities that can bring rewards and compensation. As the saying goes: "Studying hard is the best return to teachers." The purpose of live online teaching is to improve students' learning ability and academic performance. Students view improved learning ability as part of the reward exchange with teachers and platforms, generated through mutual exchange behaviors and serving as a means for students to repay teachers. Enhanced student satisfaction means students realize that live teaching platforms provide more valuable resources, which will drive students to increase investment in knowledge learning and be more willing to contribute more to live online classes, such as listening attentively, actively answering questions, providing feedback, and proactively participating in knowledge sharing activities to continuously improve their knowledge learning. Conversely, students may gradually withdraw from their learning role, find it difficult to integrate into online teaching classrooms, and even develop learning aversion. Therefore, when university students have high perceived evaluations of live online teaching platform system quality, service quality, and functional quality, they will continue knowledge sharing and communication behaviors in live teaching classrooms, thereby enhancing learning ability. Based on this, this study proposes:

H4a: Satisfaction and knowledge sharing chain-mediate the relationship between live online teaching platform system quality and university student learning ability.
H4b: Satisfaction and knowledge sharing chain-mediate the relationship between live online teaching platform service quality and university student learning ability.
H4c: Satisfaction and knowledge sharing chain-mediate the relationship between live online teaching platform resource quality and university student learning ability.
H4d: Satisfaction and knowledge sharing chain-mediate the relationship between live online teaching platform functional quality and university student learning ability.

### 4.2 Model Construction

In summary, this study proposes a theoretical framework model of live online teaching platform quality and university student learning ability (see Figure 2 [Figure 2: see original paper]), with platform system quality, resource quality, service quality, and functional quality as independent variables, knowledge sharing and satisfaction as chain mediators, and university student learning ability as the dependent variable.

## 5. Research Methods

### 5.1 Research Subjects

Affected by the pandemic, this study primarily used online questionnaires. The research team distributed questionnaire links to university students who participated in online live teaching courses during the winter vacation. The formal questionnaire distribution period was from May to July 2020, with supplementary questionnaires distributed on November 20 and 21. A total of 652 questionnaires were collected. After preprocessing, questionnaires with missing or random responses were eliminated, retaining 578 valid questionnaires to ensure data reliability and validity. The survey covered different genders, education levels, and majors, with male and female proportions of 49.7% and 50.3% respectively. The vast majority of respondents had bachelor's degrees or above, with junior college students accounting for 9.2%, undergraduates 61.4%, and graduate students 29.4%, providing a representative sample.

### 5.2 Scale Design

By reviewing relevant domestic and international literature and combining the characteristics of live online teaching platforms with actual online course teaching situations, the research team adapted and designed the study scale. The system quality, resource quality, and service quality scales were based on the Information System Success Model proposed by W. H. DeLone et al. [6], drawing on and modifying research results and scales from scholars such as S. K. Sharma [48], B. H. Wixom [49], and J. Xu [50]. The functional quality scale was designed based on the actual functions of live online teaching platforms and daily live teaching functional requirements. The learning ability scale was adapted based on the characteristics of live online teaching from relevant scales by Du Shichun [51] and Wang Jing [52], primarily examining students' independent learning, cooperation, and oral expression abilities. The satisfaction measurement scale was adapted from research scales by R. L. Oliver [53] and A. Bhattacherjee [15]. The knowledge sharing scale was also adapted based on live online teaching characteristics from relevant research scales by S. Y. Choi et al. [54] and L. Lu et al. [55]. Before formal distribution, a small-scale test was conducted, and the project team optimized, deleted, modified, and improved the scale content based on test results to enhance questionnaire rationality. The questionnaire consisted of two parts: the first part covered basic information including gender, education level, and live teaching platform used; the second part was the core section, mainly including live online teaching platform system quality, resource quality, service quality, functional quality, knowledge sharing, satisfaction, and learning ability, as detailed in Table 1 .

**Table 1. Measurement Variable Design**

| Latent Variable | Code | Measurement Item |
|---|---|---|
| Knowledge Sharing | A1 | In the live teaching platform, I can interact online with teachers about knowledge |
| | A2 | In the live teaching platform, teachers always answer my questions promptly |
| | A3 | In the live teaching platform, I can communicate well with classmates about knowledge |
| | A4 | In the live teaching platform, I am willing to share useful knowledge with classmates |
| | A5 | In the live teaching platform, I frequently participate in knowledge sharing collaborative activities |
| System Quality | B1 | The live teaching platform has a stable and smooth network environment |
| | B2 | The live teaching platform has high data security and can protect my privacy |
| | B3 | The live teaching platform can be accessed, displayed, and operated on any terminal (various mobile phones and computers) |
| | B4 | The live teaching platform has clear video, appropriate volume, and is easy to recognize |
| | B5 | The live teaching platform is simple and beautiful with an easy-to-use interface |
| Resource Quality | C1 | The live teaching platform provides rich and diverse information resources |
| | C2 | The live teaching platform provides information resources with strong learning value |
| | C3 | The live teaching platform provides information resources closely related to live courses |

| Latent Variable | Code | Measurement Item |
|---|---|---|
| | C4 | The live teaching platform can provide the information resources I want |
| | C5 | The live teaching platform can provide information resources timely and accurately |
| Service Quality | D1 | The live teaching platform can provide simple and clear user guides |
| | D2 | The live teaching platform can provide timely technical support and training |
| | D3 | The live teaching platform can provide relevant services based on my usage context (such as different locations and tasks) |
| | D4 | The live teaching platform can quickly solve problems I encounter during use |
| Functional Quality | E1 | The live teaching platform can share courseware |
| | E2 | The live teaching platform can conduct online preview |
| | E3 | The live teaching platform can conduct online sign-in |
| | E4 | The live teaching platform can conduct online live streaming |
| | E5 | The live teaching platform can connect microphones online |
| | E6 | The live teaching platform can provide video playback |
| | E7 | The live teaching platform can conduct online quizzes |
| | E8 | The live teaching platform can provide online feedback |
| Satisfaction | H1 | I believe the live online teaching platform can meet my learning needs |
| | H2 | I believe the live online teaching platform meets my expectations |
| | H3 | My experience using the live online teaching platform is pleasant |

| Latent Variable | Code | Measurement Item |
|---|---|---|
| | H4 | I am satisfied with the live online teaching platform |
| Learning Ability | I1 | Live teaching enhances my teamwork ability |
| | I2 | Live teaching improves my autonomous learning ability |
| | I3 | Live teaching improves my problem-solving ability |
| | I4 | Live teaching enhances my thinking ability |
| | I5 | Live teaching improves my information acquisition ability |
| | I6 | Live teaching enhances my oral expression ability |

## 6. Data Analysis and Results Discussion

### 6.1 Reliability and Validity Analysis

This study used Cronbach's Alpha coefficient and Composite Reliability (CR) values for reliability testing. A Cronbach's Alpha value greater than 0.8 indicates high internal reliability; greater than 0.7 indicates good internal reliability. Generally, CR values should exceed 0.7. In this questionnaire, both Cronbach's Alpha and CR values exceeded 0.8, indicating good reliability, as shown in Table 2 .

Validity was tested through convergent validity and discriminant validity. Convergent validity was primarily examined through factor loadings and Average Variance Extracted (AVE). The judgment criterion for factor loadings was 0.6, and AVE values should exceed 0.5. The questionnaire's factor loadings and AVE values met requirements (see Table 2), indicating good convergent validity. Discriminant validity was measured using the square root of AVE values and correlations between latent variables. Results are shown in Table 3 , where diagonal values represent the square root of AVE, and correlation values on the left are all smaller than the square root of AVE values, indicating good discriminant validity.

**Table 2. Factor Loadings, Cronbach's Alpha, CR Values, and AVE Values of Measurement Indicators**

| Variable | Code | Factor Loading | Cronbach's Alpha | CR | AVE |
|---|---|---|---|---|---|
| Knowledge Sharing | A1 | 0.670 | 0.852 | 0.853 | 0.537 |
| | A2 | 0.732 | | | |
| | A3 | 0.734 | | | |

| Variable | Code | Factor Loading | Cronbach's Alpha | CR | AVE |
|---|---|---|---|---|---|
| | A4 | 0.725 | | | |
| | A5 | 0.798 | | | |
| System Quality | B1 | 0.783 | 0.834 | 0.835 | 0.505 |
| | B2 | 0.659 | | | |
| | B3 | 0.660 | | | |
| | B4 | 0.711 | | | |
| | B5 | 0.732 | | | |
| Resource Quality | C1 | 0.845 | 0.890 | 0.891 | 0.622 |
| | C2 | 0.743 | | | |
| | C3 | 0.826 | | | |
| | C4 | 0.701 | | | |
| | C5 | 0.820 | | | |
| Service Quality | D1 | 0.790 | 0.866 | 0.866 | 0.619 |
| | D2 | 0.812 | | | |
| | D3 | 0.779 | | | |
| | D4 | 0.764 | | | |
| Functional Quality | E1 | 0.738 | 0.904 | 0.904 | 0.542 |
| | E2 | 0.675 | | | |
| | E3 | 0.679 | | | |
| | E4 | 0.771 | | | |
| | E5 | 0.767 | | | |
| | E6 | 0.717 | | | |
| | E7 | 0.735 | | | |
| | E8 | 0.800 | | | |
| Satisfaction | H1 | 0.771 | 0.837 | 0.838 | 0.564 |
| | H2 | 0.726 | | | |
| | H3 | 0.724 | | | |
| | H4 | 0.781 | | | |
| Learning Ability | I1 | 0.760 | 0.892 | 0.894 | 0.584 |
| | I2 | 0.718 | | | |
| | I3 | 0.757 | | | |
| | I4 | 0.775 | | | |
| | I5 | 0.778 | | | |
| | I6 | 0.794 | | | |

**Table 3. Discriminant Validity Analysis Results**

| | Resource Quality | Service Quality | Functional Quality | System Quality | Satisfaction | Knowledge Sharing | Learning Ability |
|---|---|---|---|---|---|---|---|
| Resource Quality | 0.789 | | | | | | |

| | Resource Quality | Service Quality | Functional Quality | System Quality | Satisfaction | Knowledge Sharing | Learning Ability |
|---|---|---|---|---|---|---|---|
| Service Quality | 0.615 | 0.787 | | | | | |
| Functional Quality | 0.456 | 0.459 | 0.736 | | | | |
| System Quality | 0.605 | 0.622 | 0.381 | 0.711 | | | |
| Satisfaction | 0.629 | 0.587 | 0.433 | 0.548 | 0.751 | | |
| Knowledge Sharing | 0.560 | 0.583 | 0.470 | 0.563 | 0.628 | 0.733 | |
| Learning Ability | 0.594 | 0.614 | 0.418 | 0.588 | 0.652 | 0.715 | 0.764 |

### 6.2 Model Validation

Based on research hypotheses, a structural equation model was constructed using AMOS 24.0, as shown in Figure 3 [Figure 3: see original paper]. The overall model fit is shown in Table 4 , where all overall adaptation indicators meet standards. Therefore, the proposed hypothetical model fits well with actual data, and the measurement model is valid.

**Table 4. Overall Model Fit Indices for Confirmatory Factor Analysis**

| Fit Index | Criterion | Actual Value |
|---|---|---|
| CMIN/DF | $< 3.00$ | 1.517 |
| GFI | $> 0.90$ | 0.919 |
| AGFI | $> 0.90$ | 0.970 |
| RMR | $< 0.05$ | 0.033 |
| RMSEA | $< 0.05$ | 0.030 |
| NFI | $> 0.90$ | 0.924 |
| CFI | $> 0.90$ | 0.973 |

### 6.3 Hypothesis Testing

**6.3.1 Direct Effects Testing** Structural equation modeling was used to test direct effect relationships, with path coefficient analysis results shown in Table 5 . Results show that system quality, functional quality, service quality, and resource quality of online teaching platforms all have significant direct effects on satisfaction. System quality, functional quality, and service quality have significant direct effects on knowledge sharing, while resource quality's direct effect on knowledge sharing is not significant. System quality and service quality have significant direct effects on learning ability, while functional quality

and resource quality's direct effects on learning ability are not significant. Satisfaction has significant direct effects on knowledge sharing and learning ability. Knowledge sharing has a significant direct effect on learning ability with the highest estimated coefficient, indicating that knowledge sharing is one of the most important ways to promote learning ability improvement.

**Table 5. Model Path Coefficient Analysis Results**

| Path | Estimate | S.E. | C.R. | P | Result |
|---|---|---|---|---|---|
| Knowledge Sharing ← System Quality | 0.228 | 0.060 | 3.774 | *** | Supported |
| Knowledge Sharing ← Functional Quality | 0.119 | 0.035 | 3.378 | *** | Supported |
| Knowledge Sharing ← Resource Quality | 0.066 | 0.047 | 1.416 | 0.157 | Not Supported |
| Knowledge Sharing ← Service Quality | 0.108 | 0.043 | 2.506 | 0.012 | Supported |
| Satisfaction ← System Quality | 0.139 | 0.050 | 2.799 | 0.005 | Supported |
| Satisfaction ← Resource Quality | 0.171 | 0.056 | 3.073 | 0.002 | Supported |
| Satisfaction ← Functional Quality | 0.180 | 0.068 | 2.645 | 0.008 | Supported |
| Satisfaction ← Service Quality | 0.261 | 0.050 | 5.222 | *** | Supported |
| Knowledge Sharing ← Satisfaction | 0.331 | 0.056 | 5.875 | *** | Supported |

| Path | Estimate | S.E. | C.R. | P | Result |
|---|---|---|---|---|---|
| Learning Ability ← System Quality | 0.137 | 0.062 | 2.193 | 0.028 | Supported |
| Learning Ability ← Functional Quality | -0.005 | 0.039 | -0.126 | 0.900 | Not Supported |
| Learning Ability ← Service Quality | 0.144 | 0.056 | 2.597 | 0.009 | Supported |
| Learning Ability ← Resource Quality | 0.095 | 0.052 | 1.821 | 0.069 | Not Supported |
| Learning Ability ← Knowledge Sharing | 0.490 | 0.071 | 6.859 | *** | Supported |
| Learning Ability ← Satisfaction | 0.214 | 0.057 | 3.725 | *** | Supported |

Note: P-values with "***" indicate significance at the 0.001 level.

**6.3.2 Mediating Effects Testing** Based on the above results, this study further tested the mediating effects of live online teaching platform quality on student learning ability. The Bootstrap technique used by A. F. Hayes et al. [56] was employed to test the significance of satisfaction and knowledge sharing mediating effects.

**(1) Direct, indirect, and total effects of system quality on learning ability.** As shown in Table 6 , the total indirect effect, direct effect, total effect, and specific indirect effects of system quality on learning ability are all positive and reach significance levels. This indicates that knowledge sharing and satisfaction partially mediate the relationship between platform system quality and university student learning ability, while knowledge sharing and satisfaction together play a chain-mediating role between platform system quality and student learning ability. Hypotheses H1a, H2a, H3a, and H4a are supported.

**Table 6. Direct, Indirect, and Total Effects of System Quality on Learning Ability**

| Effect Type | Estimate | SE | Bias-Corrected 95% CI | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Total Indirect Effect | 0.145 | 0.042 | 0.072 | 0.238 |
| Direct Effect | 0.137 | 0.069 | 0.008 | 0.279 |
| Total Effect | 0.282 | 0.072 | 0.152 | 0.433 |
| Specific Indirect Effects: | | | | |
| System Quality → Satisfaction → Knowledge Sharing → Learning Ability | 0.023 | 0.011 | 0.007 | 0.049 |
| System Quality → Knowledge Sharing → Learning Ability | 0.084 | 0.032 | 0.029 | 0.156 |
| System Quality → Satisfaction → Learning Ability | 0.038 | 0.020 | 0.009 | 0.087 |

**(2) Direct, indirect, and total effects of service quality on learning ability.** As shown in Table 7 , the total indirect effect, direct effect, total effect, and specific indirect effects of service quality on learning ability are all positive and reach significance levels. This indicates that knowledge sharing and satisfaction partially mediate the relationship between platform service quality and university student learning ability, while knowledge sharing and satisfaction together play a chain-mediating role between platform service quality and student learning ability. Hypotheses H1b, H2b, H3b, and H4b are supported.

**Table 7. Direct, Indirect, and Total Effects of Service Quality on Learning Ability**

| Effect Type | Estimate | SE | Bias-Corrected 95% CI | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Total Indirect Effect | 0.146 | 0.035 | 0.084 | 0.221 |
| Direct Effect | 0.144 | 0.060 | 0.024 | 0.261 |
| Total Effect | 0.290 | 0.064 | 0.164 | 0.419 |

| Effect Type | Estimate | SE | Bias-Corrected 95% CI | |
|---|---|---|---|---|
| Specific Indirect Effects: | | | | |
| Service Quality → Satisfaction → Knowledge Sharing → Learning Ability | 0.029 | 0.011 | 0.013 | 0.057 |
| Service Quality → Knowledge Sharing → Learning Ability | 0.068 | 0.027 | 0.021 | 0.129 |
| Service Quality → Satisfaction → Learning Ability | 0.049 | 0.019 | 0.018 | 0.095 |

**(3) Direct, indirect, and total effects of resource quality on learning ability.** As shown in Table 8 , the total indirect effect and total effect of resource quality on learning ability are positive and significant, while the direct effect is not significant. Among the three specific indirect effects, the "Resource Quality → Knowledge Sharing → Learning Ability" indirect effect is not significant. This indicates that satisfaction completely mediates the relationship between platform resource quality and university student learning ability, while knowledge sharing and satisfaction together play a chain-mediating role between platform resource quality and student learning ability. Hypotheses H1c, H3c, and H4c are supported, while H2c is not supported.

**Table 8. Direct, Indirect, and Total Effects of Resource Quality on Learning Ability**

| Effect Type | Estimate | SE | Bias-Corrected 95% CI | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Total Indirect Effect | 0.145 | 0.037 | 0.081 | 0.227 |
| Direct Effect | 0.095 | 0.054 | -0.011 | 0.201 |
| Total Effect | 0.240 | 0.055 | 0.137 | 0.352 |
| Specific Indirect Effects: | | | | |

| Effect Type | Estimate | SE | Bias-Corrected 95% CI | |
|---|---|---|---|---|
| Resource Quality → Satisfaction → Knowledge Sharing → Learning Ability | 0.042 | 0.013 | 0.022 | 0.074 |
| Resource Quality → Knowledge Sharing → Learning Ability | 0.033 | 0.026 | -0.013 | 0.089 |
| Resource Quality → Satisfaction → Learning Ability | 0.071 | 0.023 | 0.032 | 0.126 |

**(4) Direct, indirect, and total effects of functional quality on learning ability.** As shown in Table 9 , the total indirect effect and total effect of functional quality on learning ability are positive and significant, while the direct effect is not significant. All three specific indirect effects are positive and significant. This indicates that knowledge sharing and satisfaction completely mediate the relationship between platform functional quality and university student learning ability, while knowledge sharing and satisfaction together play a chain-mediating role between platform functional quality and student learning ability. Hypotheses H1d, H2d, H3d, and H4d are supported.

**Table 9. Direct, Indirect, and Total Effects of Functional Quality on Learning Ability**

| Effect Type | Estimate | SE | Bias-Corrected 95% CI | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Total Indirect Effect | 0.095 | 0.026 | 0.051 | 0.154 |
| Direct Effect | -0.005 | 0.042 | -0.085 | 0.079 |
| Total Effect | 0.090 | 0.044 | 0.008 | 0.181 |
| Specific Indirect Effects: | | | | |
| Functional Quality → Satisfaction → Knowledge Sharing → Learning Ability | 0.014 | 0.007 | 0.003 | 0.032 |

| Effect Type | Estimate | SE | Bias-Corrected 95% CI | |
|---|---|---|---|---|
| Functional Quality → Knowledge Sharing → Learning Ability | 0.058 | 0.022 | 0.020 | 0.107 |
| Functional Quality → Satisfaction → Learning Ability | 0.023 | 0.012 | 0.004 | 0.055 |

### 6.4 Discussion of Research Results

#### 6.4.1 Analysis and Recommendations on Direct and Mediating Effects

Live online teaching platform system quality and service quality can directly and positively affect student learning ability. Stable live teaching platform operating systems and 完善的 mobile internet technology can optimize the quality of online live teaching, help university students reduce feelings of isolation and technical difficulties in live online learning, enable users to perceive the value of live online teaching for their own learning and research, directly promote students' autonomous learning willingness, and enhance learning ability. "Satisfaction → Knowledge Sharing" plays a partial mediating role in the effects of system quality and service quality on learning ability, and a complete mediating role in the effects of resource quality and functional quality on learning ability. This demonstrates the important roles of satisfaction and knowledge sharing in live online teaching.

Currently, many university students have poor self-control and procrastination behaviors. Without the regular constraints of traditional classrooms, they find it difficult to sustain attention in live learning, and teachers struggle to control students' online attendance. Therefore, in live online teaching, to attract student attention, the teaching model must shift to student-centered autonomous internalization learning, focusing on teachers' 启发 guidance and emphasizing university students' self-learning and knowledge sharing processes. Online teaching should strengthen knowledge interaction, using the diverse functions of live online platforms to set up questions, discussions, and collaborative content, timely monitor university students' knowledge absorption and online attendance, involve students more in the classroom, and promote knowledge sharing. Through knowledge interaction, university students think about problems, express opinions, and share knowledge. Simultaneously, pushing useful disciplinary knowledge resources and providing more complete platform functions, systems, and services can enhance university students' satisfaction with the platform and learning satisfaction, stimulate their learning enthusiasm, and enable them to share useful knowledge learned through knowledge collaboration activities in teaching classrooms with other classmates, thereby promoting learning ability

improvement.

**6.4.2 Comparison of Total Effects and Recommendations** The total effect of system quality on student learning ability is 0.282, service quality is 0.290, functional quality is 0.090, and resource quality is 0.240. Ranking by absolute total effect values, the influence strength of live online teaching platform quality factors on student learning ability is: "Service Quality > System Quality > Resource Quality > Functional Quality." Service quality has the strongest effect. For university students, the purpose is to learn conveniently and efficiently. Therefore, live teaching platform service providers need to continuously improve platform management and operation to enhance service quality, such as helping university students solve usage difficulties, providing relevant services based on their usage contexts, discovering and meeting their real learning needs, and improving satisfaction. System quality ranks second, indicating that current live online teaching effectiveness is largely influenced by online platform systems. As information systems improve and human-computer interaction technology advances, students' learning costs for using information systems continuously decrease, leading to increasing potential requirements for system quality. In fact, contemporary university students, growing up in digital environments as "digital natives" [57], mostly believe they can handle various information tasks, cannot tolerate delayed information feedback, and require networks to be "always" online [58]. Therefore, live teaching platform service providers must continuously optimize technology to provide stable, 完善, and high-quality information system platforms for users. Resource quality ranks third. The importance, richness, and relevance of educational information resources enhance user satisfaction with systems [59]. Live online teaching platforms need to equip high-quality learning resources according to different teaching types and needs, constructing personalized information resource push services based on data analysis. Meanwhile, teachers can integrate teaching resources such as courseware, case studies, and self-owned resources with platform learning resources to form a rich resource system, making online teaching course construction more 完善. Functional quality has the weakest effect, mainly because compared with system quality, service quality, and resource quality, functional differences among various live platforms are small, with core functions such as courseware sharing, live streaming, and sign-in being basically universal. Even with 完善 platform functions, only core functions are applied in live teaching classrooms. Therefore, while live online teaching platform functional quality affects student ability improvement, its impact is relatively smaller.

## 7. Research Significance and Limitations

This study reveals that both satisfaction and knowledge sharing serve not as single mediators but as combined chain mediators in the impact of live teaching platform quality on university student learning ability. The contribution lies in revealing the transmission path where live online teaching platform quality enhances university student satisfaction, thereby affecting knowledge sharing,

and ultimately promoting learning ability. This expands understanding of the relationship between live online teaching and university student learning ability, and research conclusions can provide guidance for university live online teaching.

Live online teaching is a complex system still in rapid development. As information technology and knowledge needs continuously update and develop, its content, models, and methods require ongoing optimization and advancement. Although this study achieved certain results, influenced by subjective and objective factors such as personal experience levels and research object complexity, many shortcomings and issues remain, including: many representative factors may not have been considered; the amount of data collected was relatively small; and questionnaire data collection has certain subjectivity. Future research needs to address these shortcomings and further explore the relationship between live online teaching platform quality and student learning ability.

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**Abstract:** [Purpose/significance] The impact of the quality of live online teaching platform on the learning ability of university students and its path of action is discussed in order to provide a reference for the study of live online teaching in universities. [Method/process] Based on the characteristics of live online teaching, the D&M model is used as a framework, and knowledge sharing and satisfaction are used as chain mediators to construct a model of the impact of the quality of live online teaching platform on the learning ability of university students. A questionnaire survey was conducted on 578 university students and the collected data were tested. [Result/conclusion] The system quality and service quality of the platform directly and significantly positively affect the learning ability of university students; the direct impact of the platform's resource quality and functional quality on the learning ability of university students is not significant, but the indirect impact is significant; knowledge sharing and satisfaction together play a partially mediating role between the platform's system quality, service quality and the learning ability of university students; knowledge sharing and satisfaction together play a completely mediating role between the platform's functional quality, resource quality and the learning ability of university students.

**Keywords:** D&M model; live online teaching platform; learning ability; knowledge sharing; satisfaction; chain mediating effect

*Note: Figure translations are in progress. See original paper for figures.*