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Effects of Online Learning Support Services on University Students' Learning Satisfaction under the Impact of COVID-19

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Abstract: As a result of the COVID-19 pandemic, many university students have transitioned from face-to-face education in the classroom to online learning. Online learning support services (OLSS) have helped university students adapt to this new form of learning. However, the quality of OLSS may influence learning experiences and satisfaction with online learning. High-quality OLSS could improve the effectiveness of online learning and improve satisfaction rates, thus better meeting students' education requirements. Therefore, it is of great value for us to explore the effects of OLSS on university students' learning satisfaction. This study proposed three hypotheses to evaluate the effects of three dimensions of OLSS (cognitive support, emotional support, and management support) on the learning satisfaction of university students. Data were collected through a survey and were then analyzed using confirmatory factor analysis (CFA) and structural equation modeling (SEM). We found that cognitive, emotional, and management support services each had positive correlations with the learning satisfaction of university students. Overall, our results suggest that learning support services should focus on the cognitive, emotional, and management aspects of online learning, thereby meeting personalized learning needs, improving service quality, and promoting online learning.

Keywords: online learning; online learning support services (OLSS); learning satisfaction; university students

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1. Introduction

As a highly infectious disease, COVID-19 has rapidly spread around the world. Every aspect of human life has been forced to change under the disease's impact, and education is no exception. Many studies have shown that COVID-19 has had a huge influence on higher education. The living conditions and learning styles of students have been significantly altered, requiring students to invest more energy into learning [1]. Additionally, students' behaviors and use of social media to improve academic performance have been impacted [2]. These are certainly not the only aspects of education that have changed—for example, lockdowns have prevented international students from returning home and teachers from coming to campus.

In March of 2020, EDUCAUSE published *The Horizon Report 2020: Teaching and Learning Edition*. This article suggested that online learning has become the main model for sustaining education in light of health security incidents and the global epidemic. Meanwhile, with the development of AI and internet technology, online learning has gradually become an important way for university students to gain knowledge and skills. Online learning is developing at an exponential rate, especially at the level of higher education [3]. For this study, online learning not only includes synchronous online live broadcasts and real-time interactive online teaching activities but also asynchronous recorded broadcasts

as well as the use of online learning platforms for pre- and postclass autonomous learning. In this study, under the lockdown during the epidemic, online learning for university students means it replaces face-to-face courses. To ensure that education was carried out normally, through network technology, an online learning platform and related online learning support services (OLSS) were developed to maintain learning continuity. The cognitive theory of multimedia learning (CTML) highlights that the usage of the internet could enhance students' interest by providing well-designed instructional information that supports their cognitive development [4]. During internet-based online learning, students' positive experiences have a positive correlation with their interests and skills in collaboration, self-regulated learning, and information searching [5]. Most students believe that using the internet to learn in higher education makes learning more interesting and effective [6].

However, serious concerns regarding the quality of online learning have emerged with the continued growth in the popularity of online education during the COVID-19 pandemic [7,8]. More specifically, critics worry that students will not have enough face-to-face and real-time interactions with peers and teachers [9,10], fair and high-quality educational resources, or support services provided by higher education institutions [8]. Under the impact of COVID-19, online learning was chosen out of necessity. Research by Baber (2020) demonstrated that difficulties with social interaction had a negative impact on online learning during the pandemic [11]. Additionally, the work of Bangladesh university students showed that many students currently have negative opinions on online learning and that the online format increases stress related to studying [12]. Moreover, Yekefallah (2021) identified monotonous learning materials, unfamiliarity with technology, and lack of online learning hardware as the primary factors that influence satisfaction with online learning [13]. Ultimately, it is clear that COVID-19 poses a challenge to effective learning. Therefore, we must find ways to maintain online learning quality and improve satisfaction with online learning.

Learning support services serve as a specific type of remote education and have been especially prevalent during the COVID-19 pandemic. OLSS is the key to students' online learning success [14,15]. Effective OLSS stimulates positive emotions in online learning and satisfies students' requirements and expectations, thus helping students to learn and achieve sustainable development. Learning satisfaction is an important measure of online learning effectiveness. Many factors influence online learning satisfaction, including the teaching and information literacy of teachers, students' learning skills, platform functions, and learning support services [16]. The quality of learning support services has resulted in a certain level of learning satisfaction regarding online learning [17]. Furthermore, online learning satisfaction is also a crucial factor in improving the efficiency of online learning [17]. With this information in mind, our study evaluated the ability of OLSS to improve students' learning and satisfaction with online learning.

2. Theoretical Background and Hypotheses

2.1. Online Learning Satisfaction

As a psychological state that appears after specific experiences, satisfaction is an unclear and abstract feeling [18]. Learning satisfaction refers to a feeling of satisfaction and positivity after the process of learning relative to the learner's initial expectations [19]. When students believe that a teaching activity meets or exceeds their expectations, they may feel satisfied; conversely, when they believe that a teaching activity did not meet their expectations, they may feel unsatisfied [20]. Online learning satisfaction is the learner's level of satisfaction with achieving learning objectives during the process of online learning. As a positive psychological state, online learning satisfaction spans the entire online learning process, originating from online learning expectations and developing during the comparison of expectations and results. Online learning satisfaction can promote learning and maintain learners' enthusiasm for learning. Online learning satisfaction is influenced by many factors, in addition to the factors mentioned above, the student's

intellect, learning motivation, and emotional growth also positively affect their learning satisfaction [21]. In an empirical study, Su S. Q. (2012) found that a student's satisfaction depends on their expectations, quality of perceptions, and value of perceptions [22]. There is a close logical relationship between expectations, perceived value, and perceived quality—through synergistic effects, this relationship determines learner satisfaction [23]. During COVID-19, interaction and engagement both had a positive influence on online learning satisfaction [24]. Additionally, the factors of online learners, online teachers, online platforms, OLSS, and online teaching designs all impact online learning satisfaction [16]. Therefore, one of the primary goals of this paper was to understand the impact of OLSS on university students' online learning satisfaction.

2.2. Online Learning Support Services (OLSS)

Learning support services refer to all forms of support that could help and guide learners during independent study and improve their learning enthusiasm [25]. Previous studies have shown that support from teachers and parents should be provided to online students because students tend to have limited skills in self-regulated learning [26]. As a whole, learning support services are composed of inter-related and interactive information, resources, personnel, and facilities [27]. These resources satisfy the various needs of students and effectively guide, help, and promote their autonomous learning, collaborative learning, and all-around development. The first study on learning support services was "Student Support Systems in Distance Education" [28]. Since this work, there has been a great deal of research on learning support services, especially on the different models and dimensions. The concept and model of OLSS for open and distance education can be divided into three categories: systematic (managerial), affective, and cognitive [29]. A previous study classified the three components of learning support services as cognitive, emotional, and managerial [30]. Another study proposed a model of learning support services suitable for Asian learners, which included emotional support, cognitive support, and system support [31]. Overall, OLSS is essential for supporting the sustainable development and lifelong learning of online learners. They refer to various types of learning support provided by distance educational organizations, teaching management staff, and teachers to maintain online learners' motivation and facilitate their learning. Furthermore, OLSS serves as an important element in online learning throughout the entire learning process. The service object of OLSS is the online learner, the service scope is the online learning process, and the service goal is to provide learning support to students to improve their learning effectiveness. From the student's point of view, OLSS can be divided into three dimensions: cognitive, emotional, and management support [29,30]. In addition, the value of learning-support services is best reflected by students' perceptions of and satisfaction with online learning. Students' perceptions mainly relate to the efficacy of the service, the most needed service is related to students' true requirements, and students' satisfaction is the reflection of the efficiency and quality of learning-support services [32]. Additionally, the quality of OLSS significantly affects students' satisfaction with online learning [30]. With this in mind, our study explored the relationship between OLSS and learners' satisfaction. This study adopted the view of [29–31] and assessed three dimensions of OLSS: cognitive support, management support, and emotional support. In this work, we propose a series of hypotheses on the relationships between these three dimensions and learning satisfaction.

2.2.1. Cognitive Support Services (CSS)

Cognitive support belongs to the academic grouping of support services, which involves teaching and helping students to develop learning skills. This kind of support service is related to teaching and learning content, including teaching objectives, teaching content, and teaching design, as well as evaluation of and feedback on the learning process [29,30]. Here, evaluation and feedback are used by teachers and other teaching assistants who participate in the teaching process to dynamically grasp the learners' learning situation, adjust their teaching rhythms, and promote learners to actively reflect on and summarize

the learning process. In general, cognitive support aims to develop students' learning and cognitive skills. The cognitive support component of OLSS can help learners better understand the construction of individual knowledge systems through communication and reflection [33]. It also helps the self-learning abilities of students, for example, through the usage of supportive learning material [30]. Cognitive support focuses on teaching guidance, where direct guidance involves help with teaching objectives, teaching content, and teaching design. Evaluation and feedback have a positive impact on learning efficiency [34]. Cognitive support influences different factors such as user satisfaction [35]. The perceived impact of cognitive support during the process of online teaching directly determines the degree of learning satisfaction. Therefore, we put forward Hypothesis 1 (H1).

Hypothesis 1 (H1). *Cognitive support received by university students during the online learning process has a positive correlation with learning satisfaction.*

2.2.2. Emotional Support Services (ESS)

Emotional support aims to help students develop the emotional side of their learning, which includes learning motivation, self-confidence, and skills on self-regulating stress [29,30]. In online learning, emotional support refers to the services given by teachers and managers to students during interpersonal communication [36]. Teachers and students may be separated in terms of both time and space during online learning. This necessitates the stimulation to motivate learners and maintain their enthusiasm for learning. Teacher–student interaction has been found to positively impact online learning satisfaction [37]. Various forms of learning support provided by teachers and peers can effectively solve learning disabilities and meet the academic, social, and emotional needs of the learner [38]. In addition, contemporary university students are more eager to have their psychological and aesthetic needs met. Ultimately, the emotional support component of the online interface during human–computer interaction affects the learning satisfaction of university students [39]. Based on this, we infer that the emotional interactions between students and teachers, students and students, and humans and computers all affect learning satisfaction. Accordingly, we put forward Hypothesis 2 (H2).

Hypothesis 2 (H2). *Emotional support received by university students duringthe online learning process has a positive correlation with learning satisfaction.*

2.2.3. Management Support Services (MSS)

Management support mainly plays a supervisory role in the online learning process and is provided to the students to help them study online [29,30]. It is regarded as one of the main evaluation indicators for online course learning support services among open universities [40]. During the online learning process, management support serves as the strongest initial form of support for learners, which is mainly reflected in the debugging and operation of relevant equipment, as well as the maintenance and provision of the online learning platform [41]. A learning satisfaction scale that uses the teaching environment and equipment as key indicators was formulated, which would suggest the importance of management-related components of online learning [42]. Previous research has focused on the relationship between learning satisfaction and the learning environment, concluding that an appropriate learning location helps to improve student satisfaction [43]. If universities and public libraries can provide a good network and learning environment for local students, the success of students will be effectively supported [44]. The participation of teachers, counselors, and teaching management staff in the teaching process has an important impact on students' learning satisfaction [45]. In this study, we summarize the participation of teachers, counselors, and teaching management staff in online teaching, as well as the network environment and the learning atmosphere, as management support for online learning. Thus, hypothesis 3 (H3) was proposed.

Hypothesis 3 (H3). *Management support received by university students during the online learning process has a positive correlation with learning satisfaction.*

2.3. Research Model

Based on the works of literature above, this study aimed to explore whether OLSS, composed of cognitive, emotional, and management support services, has an impact on university students' online learning satisfaction. Figure 1 depicts a conceptual model of our research.

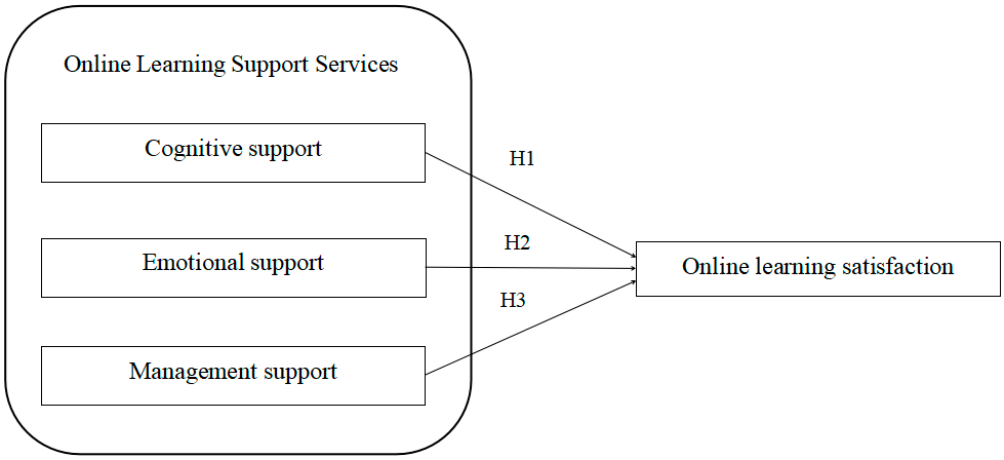

Figure 1. The conceptual model.

3. Method

3.1. Participants

This study used a stratified random sampling method to administer a questionnaire survey to university students who participated in online teaching activities at Anhui Normal University during the epidemic period. We used Questionnaire Star (https://www.wjx.cn (accessed on 6 April 2022)), which is an online survey website to send a questionnaire and collect data. To improve the representativeness of the sample and to prevent the learners in the sample coming from similar majors, which leads to research bias, we selected a general education course offered to all undergraduate and graduate students of Anhui Normal University on the "Chaoxing" online learning platform as the research course. We also used a stratified random sampling method to select undergraduate and graduate students in this course to receive links to the questionnaire. A total of 450 students took part in the online questionnaire investigation, of which 46 invalid questionnaires with missing items or completion times less than 30 s were deleted. Therefore, 404 valid questionnaires remained, and the recovery rate was 89.8%. The actual behavior data of learners were exported from the "Chaoxing" online learning platform, which is a free application. Users can self-help search and download electronic resources, browse the latest information in the online library, and learn the professional courses offered by the school. It supports group discussions and has more than one million e-books, a massive number of newspaper articles, and worldwide literature metadata to provide online learning services for users. The "Chaoxing" online learning platform brings together resources, platforms, and services. Finally, we combined the questionnaire data with behavior data to obtain all the data of the questionnaire.

3.2. Instrument

We designed a questionnaire consisting of 23 items for this study. The questionnaire included three parts. The first part included the informed consent statement. Participants were told they would participate in an anonymous survey, and that their data could be published in a research article but would not be made available for any other use. If they agreed to participate, they could continue responding to the items; if they did not want to

participate, they could exit the questionnaire. The second part was about the participants' basic information. The third part involved scales on OLSS and learning satisfaction. For these items, we used a 5-point Likert scale, which ranged from 1 for absolutely disagree to 5 for absolutely agree, with 3 as neutral.

The questionnaire used in this study focused on learning support services in online learning and learning satisfaction. Appendix A gives the items in the questionnaire.

3.2.1. Assessment of Online Learning Support Services (OLSS)

OLSS were measured from three dimensions according to [29–31]. The dimension of cognitive support included three items, such as "I think that there are clear and reasonable teaching contents and teaching objectives in online learning." The dimension of emotional support included four items, such as "I think that the frequency of questions for the teacher is appropriate in online learning." The dimension of management support included seven items, such as "I think the local network conditions can guarantee my access to online learning."

3.2.2. Measurement of Online Learning Satisfaction

This study referred to a measurement questionnaire for constructing a satisfaction model for remote learners (3 items) from [22]. To assess student satisfaction with online learning, we used teaching quality, support service satisfaction, and overall learning satisfaction as the key variables (for example, "You are generally satisfied with the OLSS").

3.3. Data Analysis

SPSS software (version 26.0) was used for the descriptive analysis of online learning behavior, as well as for correlation analysis of the OLSS dimensions. The validity and reliability of the questionnaire were evaluated by CFA via the Amos software (version 26.0). SEM was carried out to test our model.

4. Results

4.1. Participant Composition and Basic Information

Of the study participants, 372 (92.08%) were undergraduate students and 32 (7.92%) were graduate students. Additionally, 261 (64.6%) were female and 143 (35.4%) were male. Table 1 summarizes the composition and basic information of the participants.

Table 1. Basic information of participants.

Gender	Count	Percentage
Female	261	64.6%
Male	143	35.4%
Study level		
Bachelor	372	92.08%
Master	32	7.92%
Major		
Liberal arts	163	40.3%
Science	117	29.0%
Engineering	124	30.7%

4.2. Analysis of Participants' Learning Behaviors

The behavioral characteristics of participants regarding their use of the online learning platform can be expressed in terms of frequency of online learning, the average duration of online learning, and the main purpose of online learning. First, approximately two-thirds of the students reported that they use the online platform for learning every day, indicating that online learning has been normalized for university students. Nearly half

of the students studied online for 2–4 h a day, while 23.76% studied online for more than 4 h a day. Meanwhile, 11.14% of the students only studied online 1–2 times a week, which shows that some students still had low participation and enthusiasm for online learning. Second, we found that the three most common purposes for online learning in our study were as follows: "to meet their own learning needs", "to expand their knowledge", and "for tests". These responses accounted for 82.92% of the total. Overall, our results show that when providing OLSS for learners, we should fully consider the quantity and quality of online learning resources, as well as the needs of the learner. This information will help promote learners' enthusiasm and improve their satisfaction. Table 2 outlines the learning behavior details of the study participants.

Table 2. Participants' usage of online platforms.

	Category	Amount	Percentage
Frequency of online learning every week	Every day	267	66.09%
	Three or four times	92	22.77%
	Less than two times	45	11.14%
The average duration of online learning every day	Less than two hours	125	30.94%
	Among two to four hours	183	45.3%
	Over four hours	96	23.76%
The main purpose of online learning	Interest in learning	21	5.2%
	To meet their learning needs	235	58.17%
	To expand their knowledge	51	12.62%
	For tests	49	12.13%
	Reconfirm learning resources	28	6.93%
	Go with the flow	16	3.96%
	Other (requirements of school or teacher)	4	0.99%

4.3. Nonparametric Tests of Students' Learning Satisfaction with the Frequency of Online Learning and the Average Duration of Online Learning

SPSS (version 26.0) was used to determine if there was a significant relationship between student satisfaction with OLSS and the frequency of online learning or the average duration of online learning. Because the test of normality $p = 0.000 < 0.05$, the hypothesis of a normal distribution of data was denied. Therefore, a nonparametric test of independent samples was carried out. The results of the "Kruskal Wallis H" test showed that there were differences in students' satisfaction with OLSS with different learning frequencies and duration ($p < 0.05$). Subsequently, we conducted a post hoc analysis that involved multiple comparisons among multiple groups. The result showed that in the aspect of "Average Duration of Online Learning every day," students who learned online for over 4 h a day had higher satisfaction with OLSS compared to students who learned online for 0–2 h a day ($p = 0.002$). There were no significant differences between any of the other groups. In the aspect of "Frequency of Online Learning every week," students who learned online every day had higher satisfaction with OLSS compared to students who learned online 1–2 times a week ($p = 0.025$). There were no significant differences between any of the other groups. Our results show that online learning frequency and average duration can reflect participation and satisfaction with online learning (Tables 3 and 4). Therefore, educators and teaching management departments alike may improve online learning participation and satisfaction by providing better OLSS.

Table 3. Kruskal–Wallis test (H test).

Hypotheses	Significance	Decision
In the category of "Average duration of online learning," satisfaction with online learning support services has the same distribution	0.009	Hypothesis denied
In the category of "Frequency of online learning," satisfaction with online learning support services has the same distribution	0.046	Hypothesis denied

Table 4. Multiple comparisons between groups.

	Sample 1–Sample 2	Test's Statistic	Root Mean Squared Error	Significance
The average duration of online learning every day	3–2	24.441	13.373	0.068
	3–1	47.710	15.640	0.002
	2–1	23.269	14.523	0.109
Frequency of online learning every week	2–3	−3.699	20.964	0.860
	2–1	27.502	18.571	0.139
	3–1	31.201	13.932	0.025

Note: Progressive significance (two-sided test) was shown. The significance level was 0.05. The average duration of online learning every day: 1 = less than two hours; 2 = two to four hours; 3 = over four hours. Frequency of online learning every week: 1 = less than two times; 2 = three or four times; 3 = every day.

4.4. Validity and Reliability Analysis

The validity and reliability were tested by Cronbach's alpha coefficient analysis in SPSS 26.0. According to [46], if Cronbach's alpha value is >0.7, the internal consistency and reliability of the study are high. For our study, we obtained a Cronbach's alpha value of 0.877, meaning our research demonstrates high consistency. In addition, the KMO value was 0.861, indicating that the data apply to factor analysis. Furthermore, our results for the Bartlett test of sphericity (chi-square value: 6658.872; $p < 0.01$) suggest that our work has good validity.

AMOS 26.0 was used to conduct CFA on each factor in the hypotheses, and the convergence effectiveness of each potential variable in the measurement factors was evaluated through standardized factor load, combined reliability (CR) value, and average variance extracted (AVE) to ensure the validity of the scale. Firstly, items with factor loading values <0.5 in each construct need to be deleted [47]; thus, MSS1 (Teaching equipment management) and MSS2 (Teachers' information literacy) were deleted. Secondly, the combined reliability of the latent variables was >0.7, and the AVE value was >0.5, indicating good convergence of the scale. Therefore, the research model had good internal consistency and good convergence (Table 5).

Table 5. Reliability and validity of the research variables.

Research Variables	Analysis Item	Standardized Factor Load	CR	AVE
CSS	CSS1: Compliance level of teaching objectives and content	0.784	0.8557	0.6642
	CSS2: Compliance level of instructional design	0.838		
	CSS3: Compliance level of learning materials	0.822		
ESS	ESS1: Frequency of teachers' answers and questions	0.853	0.9528	0.8357
	ESS2: Frequency of peers' responses and interactions	0.997		
	ESS3: The speed of answering questions by teachers or peers	0.802		
	ESS4: Platform interface friendliness	0.989		
MSS	MSS3: Counselors participate in teaching management	0.920	0.9173	0.6919
	MSS4: Teaching staff management	0.914		
	MSS5: The quality of teaching resources	0.708		
	MSS6: Local network conditions	0.869		
	MSS7: Managed learning environment	0.722		
LS	LS1: Learner's expectations	0.871	0.9361	0.8301
	LS2: The quality of online learning support services	0.930		
	LS3: The value of online learning support services	0.931		

4.5. Correlation Analysis

Table 6 lists the correlation coefficient values between learning satisfaction and cognitive support (0.302), emotional support (0.198), and management support (0.309). All of these relationships were significant ($p < 0.01$), indicating that learning satisfaction is positively correlated to each of the three dimensions of OLSS. Management support had the highest correlation with learning satisfaction. In addition, we found that the correlation coefficient between cognitive and emotional support was 0.157 and that between cognitive and management support was 0.112. These findings indicate that cognitive support has a significant positive relationship with emotional and management support ($p < 0.05$). We also found that the correlation coefficient between management and emotional support was −0.115, indicating that there was a significant negative correlation between these variables ($p < 0.05$).

Table 6. Pearson correlation coefficient analysis of support services of students' online learning.

	CSS	ESS	MSS	LS
CSS	1			
ESS	0.157 **	1		
MSS	0.112 *	−0.115 *	1	
LS	0.302 **	0.198 **	0.309 **	1

Note: * $p < 0.05$ ** $p < 0.01$.

4.6. Model Fit Analysis

We used six evaluation fitting degree indexes (CMIN/DF, GFI, AGFI, CFI, IFI, and RMSEA) to verify the adaptability of the OLSS satisfaction model. Kline suggested that the combination of CMIN/DF < 3, GFI, AGFI, CFI, and IFI > 0.90, and RMSEA < 0.08 may represent acceptable goodness of fit [48]. We found that each fitting degree index for our research model met its corresponding recommended value (CMIN/DF = 2.735, GFI = 0.929, AGFI = 0.903, CFI = 0.974, IFI = 0.974, and RMSEA = 0.066). Therefore, our research model has a good degree of fit (Table 7).

Table 7. Overall model fitting evaluation.

Fit Index	CMIN/DF	GFI	AGFI	CFI	IFI	RMSEA
Suggestive Value	<5	>0.8	>0.8	>0.9	>0.9	<0.1
Model Value	2.735	0.929	0.903	0.974	0.974	0.066

4.7. Path Analysis and Verification of Hypotheses

In this study, we analyzed the standardized path coefficients of our model. The standardized path coefficient of potential variables was used to measure the influence degree between variables and to verify the hypotheses of this study, as shown in Table 8.

Table 8. Correlation coefficient path value between variables in the model.

Path	Estimate	S.E.	C.R.	*p*	Supported
LS←CSS	0.304	0.058	5.270	0.000 ***	Yes
LS←ESS	0.186	0.044	4.179	0.000 ***	Yes
LS←MSS	0.381	0.052	7.390	0.000 ***	Yes

Note: *** $p < 0.001$.

We identified a positive correlation between cognitive support and learning satisfaction, as well as between emotional support and learning satisfaction. In addition, the management support had a significant positive relationship with learning satisfaction. Therefore, hypotheses 1, 2, and 3 were all verified. In addition, this study calculated the effect size of learning satisfaction, the R^2 which is 0.362 was a small effect (see Figure 2).

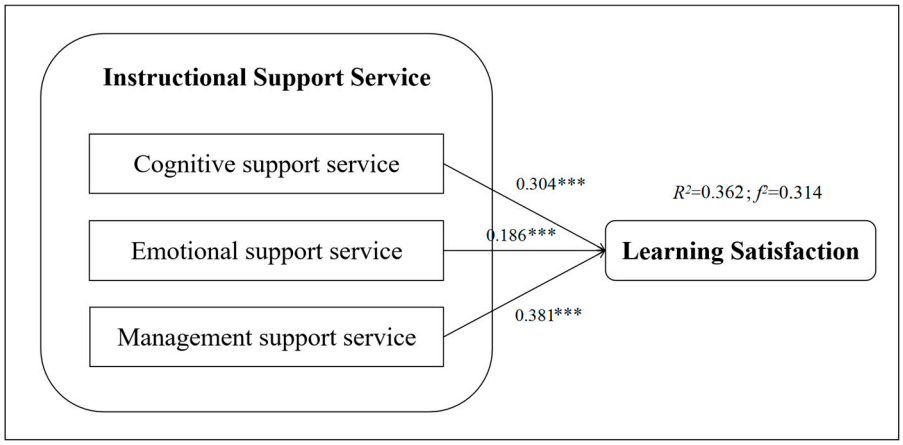

Figure 2. The revised model. Note: *** $p < 0.001$.

5. Discussion

In this study, we assessed the ontological value of OLSS in providing various academic and nonacademic services in terms of three dimensions: cognitive support, emotional support, and management support. Academic services refer to teaching and learning content, while nonacademic services are related to teaching management and student emotions. We found that each of these three dimensions positively influenced student online learning satisfaction during the COVID-19 pandemic.

5.1. Cognitive Support Has a Positive Correlation with Learning Satisfaction

The results of our study support H1. Cognitive support positively influenced student online learning satisfaction. This indicates that the greater the support in terms of teaching objectives and content, instructional design, and learning materials for online learning, the higher the online learning satisfaction of university students. The interaction between learners and learning materials occurs when learners reflect on the information, knowledge, or views obtained in classroom learning and take them as the experience gained in curriculum learning. During the teaching process of online learning, students spend most of their time interacting with learning materials, which largely affects their online learning satisfaction [49].

As one of the key factors that impact learning effects, learning material is an important component in determining student learning satisfaction with online learning cognitive support. Therefore, instructional design should focus on the degree of relevance to the course content, and learning materials should be promptly updated and managed [50]. Teachers should make full use of the advantages of the internet, choose appropriate media forms to present teaching content, and try to select a design that students believe is most helpful to them, all while maintaining accurate communication of teaching information [51].

5.2. Emotional Support Has a Positive Correlation with Learning Satisfaction

The results of our study also support H2. Emotional support positively affects student learning satisfaction. The interaction between learners and teachers has the greatest effect on predicting online learning satisfaction [31,52]. Furthermore, some studies have shown that the impact of learner–learner emotional interaction on online learning satisfaction is greater than that between learners and teachers [53].

Other research has emphasized the importance of constructing interpersonal relationships and promoting effective communication between students, teachers, and university counselors in the learning process [54]. Emotional support mainly refers to that for students, which occurs during teaching interactions and is typically provided by the teacher or other staff. In addition, it is important to design flexible and diverse interactive activities in the online classroom while keeping students' learning needs in mind [55]. The capacity for

emotional support on the online platform interface is the basis for emotional interaction between learners, teachers, and peers. Therefore, during the construction and optimization of OLSS, user-friendliness of the platform interface and convenience of functions should be prioritized. These measures ensure a good space for emotional interaction between teachers, peers, and learners, and contribute to learner satisfaction with online learning courses.

5.3. Management Support Has a Positive Correlation with Learning Satisfaction

Finally, the results of our study support H3. Management support mainly plays a supervisory role, urging learners to complete the learning content through process management. Similar to teachers, counselors, and educational administrators participating in the online learning process, the teaching environment (both network environment and learning atmosphere) and the quality control of teaching resources have positive effects on student online learning satisfaction. Previous research has identified a significant correlation between the learning environment and student satisfaction [56]. The higher the degree of support for relevant internet devices, the more willing learners are to use the internet to solve problems during learning activities, and the more they prefer the online learning environment [57].

The optimization of management support also involves improving the management mode of teachers and the auxiliary management of counselors. Our survey showed that the most important management support function for students is the real-time display of the network platform. Teachers should learn to make good use of the functions provided by the network teaching platform in their curricula. Additionally, online learning provides a good way for university counselors to participate in classroom teaching. For teaching staff management support, university counselors assisting with online teaching can monitor and instantly evaluate student participation. This allows them to provide timely feedback to both teachers and students, thus overseeing the learning process and helping learners to improve their responsiveness [58].

6. Conclusions

The COVID-19 pandemic allowed online education to develop and serve as a convenient way for continuing education. Online learning is conducive for people to achieve lifelong learning and sustainable development. However, many challenges have come along with the benefits of online learning. For example, there were many trending crash-related topics at the start of the pandemic, including "*Chaoxing* crashed" and "*MOOC* crashed." Problems such as flashbacks and crashes occur on online platforms due to surges in visits. In this situation, the basic requirements for online learning were not satisfied, meaning that personalized requirements were not met through the online learning materials. This led to decreases in learning effectiveness and student satisfaction with online learning. To promote the positive development of online learning and to improve online learning satisfaction, many studies recommended that the quality of OLSS be improved [15,16,18]. In this study, we focused on evaluating OLSS through the lens of three dimensions: cognitive support, emotional support, and management support. We analyzed the relationships between these three dimensions and students' online learning satisfaction. First, we found that cognitive support has a positive influence on online learning satisfaction, suggesting that the more support regarding teaching goals, content, design, and material provided in online learning, the better the online learning satisfaction. Second, we found that emotional support has a positive influence on online learning satisfaction, suggesting that teacher–student and student–student interactions have a positive influence on online learning satisfaction. Additionally, the friendliness of the interface and usability of functions on the online learning platform is important. The online platform provides a space for teachers and students to communicate. The support provided by the interface on the platform is also helpful. Third, management support has a positive impact on online learning satisfaction, indicating that teacher and counselor participation in online learning, the learning environment (both internet situation and learning atmosphere), and the management qual-

ity of online learning materials all have a positive impact on online learning satisfaction. Therefore, in the future online learning process, we should provide academic (related to teaching and learning content) and nonacademic (related to management and emotion) support services to learners through the three dimensions of cognitive, emotional, and management support to improve student satisfaction with online learning. The results of this study better inform us of how to achieve an improved online education system for teachers, students, and educational management departments alike.

6.1. Implications

The theoretical significance of this study is as follows. First, the difficult situation caused by COVID-19 was unprecedented. This is the first time that the education system has had to provide service to millions of students through online education, especially under such special conditions. This study investigated online learning and teaching to assess the importance of online education in promoting people's lifelong learning and sustainable development. Second, this study recategorized OLSS into the following three dimensions: cognitive, emotional, and management support services. Our results indicate that all three dimensions have a significant positive impact on student satisfaction with online learning. Furthermore, they are helpful to improve online learning satisfaction, fitting students' actual needs during learning online, and ensuring the effectiveness of online learning.

The practical significance of this study is, first, our results may inform us of how to enhance the understanding of OLSS and online learning satisfaction of students, teachers, and the management staff, thus popularizing online education and improving the sustainable development of learners. Second, our results could provide advice on OLSS to online learning management in higher education. From the perspective of cognitive support, we must give more attention to the digitizing and comprehensive planning of learning materials. Furthermore, education management departments should ensure standardization and dynamic updating of learning materials. Additionally, materials that promote personalized development and creativity should be provided. From the aspect of emotional support, teachers and counselors should pay more attention to students' emotional needs during online education, promote interactions between peers and teachers, and answer questions on time to maintain learning motivation [59]. These measures may ensure that students are satisfied with the online learning process. The UI design and platform interaction features should also be improved to promote satisfaction. Finally, from the perspective of management support, network-related technology should be improved. Universities should provide technical support to fix any technical failures that students may encounter and should also supply the necessary communication facilities and campus networks [60]. Additionally, teachers and management staff should learn to use all functions of the online learning platform and make full use of the data it records.

6.2. Limitations and Future Study

Under the impact of COVID-19, online education was widely adopted in colleges and universities. Teachers and management departments should provide OLSS to students to create a learning environment that combines synchronous and asynchronous learning, thus satisfying students' requirements for personalized learning and improving user satisfaction. Although this study enriched theoretical research in the field of OLSS and online learning satisfaction, some shortcomings should be addressed in future research. First, online learning satisfaction could be influenced by a variety of factors, such as those related to students, those related to teachers, and those related to platform function and service [17,18]. This study only focused on factors related to OLSS and only investigated three dimensions of OLSS. Future work should combine the particularity of students from different entry angles to address this weakness. OLSS needs to be further improved through collaboration and in-depth research—there is still much to be done in this regard [61]. Second, this study did not provide a detailed discussion of the specific subdimensions that fall under our

three dimensions of OLSS, nor the potential relationships between them. For example, future research should consider the impact of counselors joining online class management teams, or the emotional support provided by the online platform interface. Third, this study was carried out at a key provincial comprehensive university in China. The subjects were students of the university who participated in online learning during the pandemic. This means that our research data only came from students at one school, without considering other schools or regions. Therefore, future studies should test our results using a broader and more representative sample, thereby improving external validity. Finally, the primary instrument used in this study was a self-designed questionnaire, which passed our reliability and validity testing but could still be improved [62–64].

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Appendix A

Table A1. Items used in the survey.

Part 1: Informed Consent to Fill in the Questionnaire
Dear students, Hello! Thank you for your help to participate in this questionnaire. Before you decide to fill out the questionnaire, please make sure you have understood the following contents. This questionnaire aims to explore the effects of online learning support services on university students' learning satisfaction. This questionnaire consists of two parts; the first part is some basic information about you; there is no need to fill in your name. The second part is the related questions about your opinions on online learning. Each question has no right or wrong answer. Please choose the most suitable response base on your real situation and thoughts. This is an anonymous survey completely voluntary, which does not involve your personal privacy information and will not have any impact on your daily life. Your data may be published in a research article but would not be made available for any other use. If you agree to participate, please continue responding to the items; if you are unwilling to participate, please do not answer the questions and exit this web page. Thanks again.

Table A1. *Cont.*

Part 2: Basic Information		
Gender	A. Male B. Female	
Level of education	A. Undergraduate B. Graduate	
Major	A. Liberal arts B. Science C. Engineering	
The average duration of online learning every day	A. Less than two hours B. Two to four hours C. Over four hours	
Frequency of online learning every week	A. Less than two times B. Three or four times C. Every day	
The main purpose of online learning	A. For learning requirements B. Re-integrate learning material C. Just for interest D. To expand knowledge E. Forced by others and a general trend F. For tests and exams G. Other	
Part 3: Survey of satisfaction of online learningsupport services		
Research Variables	Analysis item	Items used in the survey
Cognitive Support Services (CSS)[29–31,33–35]	CSS1: Compliance level of teaching objectives and content	I think that there are clear and reasonable teaching contents and teaching objectives in online learning.
	CSS2: Compliance level of instructional design	I think the design of online learning can support my study pre-, in-, and postclass.
	CSS3: Compliance level of learning materials	I think the updated pace of learning resources and course contents in online learning is suitable for my study.
Emotional Support Services (ESS) [29–31,36–39]	ESS1: Frequency of teachers' answers and questions	I think that the frequency of questions for the teacher is appropriate in online learning.
	ESS2: Frequency of peers' responses and interactions	I think that classmates who study together can respond promptly and interact effectively in online learning.
	ESS3: The speed of answering questions by teachers or peers	I think the pace of answers from my teacher and peers may influence my study in online learning.
	ESS4: Platform interface friendliness	I think the UI design of the online platform is friendly and easy for online learning.
Management Support Services (MSS) [29–31,41–45]	MSS1: Teaching equipment management	Teachers check and adjust hardware and related equipment before the online learning begins.
	MSS2: Teachers' information literacy	Teachers smoothly use online instruments for learning resource searching, integration, and sharing.
	MSS3: Counselors participate in teaching management	The school counselor is involved in the entire learning process of online learning.
	MSS4: Teaching staff management	The related administrative staff is involved in the entire process of online learning.
	MSS5: The quality of teaching resources	I think the quality of learning resources is acceptable for my online learning.
	MSS6: Local network conditions	I think the local network conditions can guarantee my access to online learning.
	MSS7: Managed learning environment	I think my study atmosphere during online learning is appropriate for my learning process.
Learner's Satisfaction (LS) [22]	LS1: Learner's expectations	The support services provided during online learning met my expectations.
	LS2: The quality of online learning support services	In general, I was satisfied by the quality of the online learning support services.
	LS3: The value of online learning support services	I think the online learning support services provided during online learning were beneficial to my learning.

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