

Analysis of the Impact of Students' Perception of Course Quality on Online Learning Satisfaction

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In the early 2020, COVID-19 changed the traditional way of teaching and learning. This paper aimed to explore the impact of college students' perception of course quality on their online learning satisfaction. A total of 4,812 valid samples were extracted, and the difference analysis and hierarchical regression analysis were used to make an empirical analysis of college students' online learning satisfaction. The research results were as follows. Firstly, there was no difference in online learning satisfaction among students by gender and grade. Secondly, learning assessment, course materials, course activities and learner interaction, and course production had a significant positive impact on online learning satisfaction. Course overview and course objectives had an insignificant correlation with online learning satisfaction. Thirdly, the total effect of online learning satisfaction was as follows. Course production had the greatest effect, followed by course activities and student-student interactions, followed by course materials. It was the learning evaluation that showed the least effect. This study can provide empirical reference for college teachers on how to continuously improve online teaching and increase students' satisfaction with online learning.

Keywords : Online learning, Perceived quality of course, Learning satisfaction, Hierarchical regression analysis

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Introduction

In 2020, a sudden COVID-19 epidemic forced online teaching methods to completely replace traditional teaching methods in a certain period of time. This is the first time for such large-scale online teaching in the world. So, has the vision of information technology promoted the improvement of teaching quality that people expected has been realized? According to the “Analysis Report on the Status and Quality of Online Teaching in National Colleges and Universities—A Comprehensive Survey Report from 86 Universities of Various Types” (China Education All Media, 2020) released by CIQA (China university Internal Quality Assurance), online teaching has outstanding problems such as insufficient system support, insufficient capacity of course resources, and lack of teacher competency in designing information education, which have led to insufficient online learning effects for students. As Robert (2016) said, the information technology that people hope to promote the transformation of education is not an overnight process. Also, as Allen and Seaman (2010) pointed out that compared with classroom teaching, the effect of online learning is not outstanding. Therefore, how to continuously improve the quality of online courses is a question worthy of continuous exploration.

Online teaching, as a new teaching mode, the group of college students occupies an important part. Their service quality provided by the education platform or perceived quality of online courses directly affect their satisfaction and have a significant impact on their willingness to continue online learning (Su, 2021). Roach and Lemasters (2006) pointed out that according to the characteristic of online education, learners' satisfaction in online education is more important when compared to offline education. Precedent research has shown that the online learning satisfaction of courses, such as MOOC/SPOC, can be predicted by many variables. For example, learners' motivation (Eom, Wen, & Ashill, 2006), teacher-student interaction (Diekelmann & Mendias, 2005), teaching resources and learning guidance (Chen & Cao, 2020), flexibility and quality of online courses (Li, Zhang, & Zhang,

2020; Xie, Liu, Zhu, & Yin, 2011; Xu, Zhao, & Liu, 2017), self-efficacy (Prior, Mazanov, Meacheam, Heaslip, & Hanson, 2016), and autonomous learning ability (Wei & Chou, 2020) can positively predict online learning satisfaction. After Jeffery, Charles, Kristian, and Lisa (2013) summarized and analyzed more than two hundred master's and doctoral dissertations about online education satisfaction, his team emphasized research trends such as interest in learners in the demographic aspect, the influence of student learning effects, teaching design, teaching interaction, and course quality, and so forth.

In addition, from previous studies, many scholars have proposed that course quality is an important factor affecting students' learning satisfaction (Li et al., 2020; Ismuratova, Naurzbaev, Maykopova, Madin, & Ismuratova, 2017). As Sener and Humbert (2003) said, among the many factors that affect the quality of students' online learning, the quality of online courses has always been an important predictor. In particular, during the pandemic, online courses are not only an alternative to offline learning, but also a way for students to gain academic results. In this case, it is reasonable to assume that students' perception of the quality of online courses is an important predictor of students' learning satisfaction. In recent years, many scholars have also studied the quality of online courses from the perspective of students (Chitkushev, Vodenska, & Zlateva, 2014; Jones & Blankenship, 2017; Lowenthal, Bauer, & Chen, 2015). Jackson and Helms (2008) further stated that "learners' perception provides key information to evaluate and define quality."

In this context, this study sought to explore the satisfaction of online learning during the epidemic from the perspective of the perception of course quality by college students. Therefore, this paper aimed to analyze the impact of different quality dimensions of online courses on college students' online learning satisfaction to provide guidance strategies for teachers to improve the quality of online courses. At the same time, this study also enriches the practical research on learners' online learning satisfaction in different environments.

The specific questions set in the study are as follows:

First, do students with different demographic characteristics have differences in perception of online course quality and online learning satisfaction?

Second, how do the constituent elements of online courses perceived by students affect students' online learning satisfaction?

Literature Review

Online Learning Satisfaction

Online learning satisfaction has different definitions. Fang, Cui, and Yang (2016) believed that the overall feeling and subjective evaluation formed by online learners after comparing the differences between learning perception and learning expectation is learning satisfaction. Zuo, Zhang, and Li (2021) believed that students' comprehensive evaluation of teachers' teaching ability, platform construction, platform classification and performance assessment after learning online open courses is learning satisfaction. It can be seen that learning perception and quality evaluation are the important connotation of the concept of learning satisfaction.

In order to comprehensively discuss the influencing factors of online learning satisfaction, researchers have diverse research perspectives. Diekelmann and Mendias (2005) studied the online teacher-student relationship and believed that supportive online teachers can regulate students' interaction, ensure a mutually respectful environment for online learning, and make students feel fair, which are very important for online learning. Baran, Correia, and Thompson (2011) believed that teaching practice is an important predictor of students' learning concept and learning satisfaction. Wang, Ju, and Ge (2014) insisted that the main factors affecting the good teaching effect are the good interaction between the online learning design and the empirical model.

Borup, Graham, and Davies (2013) found a significant correlation between learner

interaction and course satisfaction. The correlation between learner interaction and course satisfaction was higher than that between learner-course content or learner-teacher interaction and course satisfaction. Zheng and Liang (2014) believed that designing different teaching activities, promoting students' interactive discussion, and providing learning information, learning feedback or guidance are important factors to improve online learning satisfaction. Hu and Zhao's research (2015) showed that teachers' online teaching attitude is the key factor affecting learning satisfaction. Ismuratova et al. (2017) suggested that teacher attitude, course quality, multiple assessment and learners' anxiety about computer use are also key factors affecting learners' learning satisfaction. Bervell, Umar, and Kamilin (2020) showed that several factors such as personal innovativeness, student-material interaction, student-student interaction and student-teacher interaction have been suggested as enablers of satisfaction in online learning environments. The factor of online learning satisfaction revealed that complex non-linear relationships exist among these variables, such that student-teacher interaction determines student-student interaction whereas personal innovativeness influences student-material interaction.

On the other hand, Jeong (2021) analyze differences in satisfaction with remote learning after the outbreak of COVID-19 among different college students. She pointed out that there were differences in online course satisfaction among students by genders and grades.

Previous studies have shown that from the learning environment to the subject of learning, from teacher teaching to student learning, all factors involved may affect student learning satisfaction. It can be said that student satisfaction with online learning is a complex multi-level structure with a wide range of influencing factors (Saadé & Kira, 2006), and the course quality is also one of the important influencing factors.

Perceived Quality of Online Courses

Course quality is the lifeline of talent training. Among the many influencing factors

of learning satisfaction, online course quality is one of the important predictors. For a long time, the course quality evaluation of Chinese colleges and universities has been based on the evaluation of teachers by the management department. The evaluation contents include teachers' quality, teaching process, teaching methods, teaching contents, teaching effects and evaluation methods (Chen, Han, Wang, & Zhang, 2019). With the prevalence of "learner centered" theory, universities have realized that the evaluation of course quality also needs to be viewed from the perspective of students. Therefore, there are more and more studies on students' perceived evaluation of course quality and learning satisfaction. Some researchers use customer satisfaction models to study students' online learning satisfaction and its influencing factors. Sheng and Chen (2009) studied teachers' teaching satisfaction from the dimensions of course teaching perceived quality. Considering the situation of Chinese universities, Liu (2011) constructed a Chinese college student learning satisfaction model based on the American customer satisfaction index (ACSI) model. Through empirical research, this model confirms that there is a significant positive correlation between college students' perceived course quality and college students' learning satisfaction.

As mentioned above, online course quality is not a static, one-way and one-dimensional concept. Online course quality includes a series of learning activities with course design as the core element. The course quality perceived by students is closely related to a series of teaching and learning behaviors in the course teaching process. The course quality includes course overview and introduction, learning objectives, assessment and measurement, instructional materials, learner interaction, course media and technology, and learner support (Ralston-Berg, Buckenmeyer, Barczyk, & Hixon, 2015; Ralston-Berg & Nath, 2008). In order to deeply investigate some factors related to the quality of online courses, scholars discussed the relationship between some of them and learning satisfaction. Qian (2015) studied the influencing factors of user satisfaction of MOOC platform in social network environment for online learning users of China's MOOC platform. The results showed that course content

significantly affected online satisfaction. The content of the course covers the introduction of the general situation of the course, the learning objectives of the course, the course resources and other specific projects. Zhang and Lin (2014) said that the quality of classroom teaching, including course introduction, course objectives, learning assessment, learning resources, etc., has a significant positive impact on teaching satisfaction. Eom and Ashill (2016) investigated the effects of teacher role, course design, course production, teacher-student interaction, student-student interaction, etc. on student satisfaction, which showed that teaching interaction, course design, and course production all had significant positive effects on student satisfaction. Guo and Cao (2018) proposed that classroom teaching quality, information quality, and support service quality have significant positive effects on learning satisfaction. Many scholars found that the quality of classroom teaching, especially learning interaction, positively affected college students' online learning satisfaction (Li et al., 2020; Xie et al., 2011; Xu et al., 2017). Yang and Wang (2020) figured out that external support, teacher-student interaction, teaching contents, and student-student interaction had significant positive effects on college students' online learning satisfaction. Mumford and Dikilitas (2020) discussed the positive relationship between online interactive learning and learning satisfaction through the research on online teaching of pre-service teacher education. Swan (2001) conducted a satisfaction survey of 1,406 online learners and found that the interaction and feedback between teachers and students, the discussion and mutual assistance between students, and the clarity of teachers' course design are three significant factors that affect student satisfaction. Gallien and Oomen-Early (2008) found that learning assessment and feedback could moderately predict students' satisfaction and performance. The dissatisfaction with online courses is mainly related to the lack of timely feedback, technical difficulties, and ambiguous course description (Hara & Kling, 1999).

Meanwhile, Liu and Cui (2020) conducted a questionnaire survey of 3,072 college students who participated in online course learning and found that gender and grade

have certain differences in the perceived quality of online courses.

From the previous research, we know that the concept of online course quality is a multi-dimensional and rich. Course overview, course objectives, learning assessment, course materials, course activities and learner interaction, and course production are important dimensions of the evaluation of online course quality. Therefore, this paper mainly explores the impact of various dimensions of students' perceived quality on online learning satisfaction through the analysis of the above six aspects.

Research Method

Research Hypothesis

The purpose of this study was to analyze the influence of different quality dimensions of online courses on college students' online learning satisfaction during the epidemic. To achieve this, the research set up the hypothesis as follows.

H1. Satisfaction with online learning and the perception of the quality of online course will differ depending on demographic factors of college students.

H2. The quality of online courses perceived by college students will affect their satisfaction with online courses.

Research Participants

The study was conducted at a university in China from May 10 to 15, 2020. The participants were undergraduates in their first to third years of college. Students with student number ending in 1, 3, 5, 7, or 9 were sampled according to the proportion of students in each major. A total of 5,820 questionnaires were sent out and 5,216 were collected. Excluding incomplete questionnaires, a total of 4,812 valid

questionnaires were obtained, with an effective rate of 92.25%. In this survey, female students accounted for 4,187 (87.0%) and male students accounted for 625 (13.0%), which was consistent with the gender ratio of current primary school teachers. The grade distribution of participants was as follows: freshman accounted for 1,575 (32.7%), sophomore accounted for 1,661 (34.5%), and junior accounted for 1,576 (32.8%). At the same time, in order to investigate whether learning hours affects online teaching satisfaction, the number of students with different online learning hours was counted in this study. 135 students (2.8%) studied online for more than 12 hours per day, 1,035 students (21.5%) studied online for more than 8 hours but less than 12 hours, 3,198 students (66.5%) studied online for more than 4 hours but less than 8 hours, and 444 students (9.2%) studied online for less than 4 hours. The specific demographic characteristics are shown in Table 1.

Table 1. Demographic Characteristics of Participants (N=4,812)

Category		Frequency	Percentage
Gender	Male	625	13.0
	Female	4,187	87.0
Academic Year	Grade 1	1,575	32.7
	Grade 2	1,661	34.5
	Grade 3	1,576	32.8
Length of Study (a day)	Over 12h	135	2.8
	8h-12h	1,035	21.5
	4h-8h	3,198	66.5
	Below 4h	444	9.2

Research Tools

Perceived Quality of Online Courses Scale

In this study, we used the FD-QM Online/Hybrid Course Quality Standard (CIQA, 2017) developed by The Teaching Development Center of Fudan University to measure students' perception of online course quality. FD-QM standard is a Chinese transformation of QM standard (CIQA, 2019). The QM (2020) standard was

designed and developed by the Maryland Online Consortium, a world-renowned online education quality assurance agency (Shattuck, 2015). The QM standard has been validated by a large number of studies (Alizadeh, Mehran, Koguchi, & Takemura, 2019; Hoffman, 2012; Legon, 2015; Ralston-Berg et al., 2015; Ralston-Berg & Nath, 2008). At present, the FD-QM standard retains the essence of the QM standard, including 8 dimensions and 33 indicators, which are course overview, learning objectives, learning assessment, course materials, course activities and learner interaction, course technology, learner support, and course production. In view of the fact that the two dimensions of course technology and learner support in the standard are not closely related to the purpose of this study, this study selected six dimensions (27 items) in the “FD-QM” standard to measure the students' perceived quality of online courses. In order to test the validity and reliability of the extracted variables, the scale was pre-tested. Six factors were extracted through exploratory factor analysis, which were consistent with the original standard. However, five of the 27 items had a factor loading of less than 0.4, so it was necessary to delete the five items (Stevens, 1992). Finally, the perceived quality of online courses scale used for formal investigation consisted of 6 factors and 22 items and they were as follows.

First, course overview (4 items) mainly investigated students' understanding of online course purpose, content, teaching methods, evaluation methods, and teachers. Second, course objectives (3 items) mainly investigated the achievement of the learning objectives of the course. Third, learning assessment (4 items) mainly investigated whether the evaluation standards and evaluation methods were suitable for students to understand their own learning conditions and whether they could promote students' learning development. Fourth, course materials (4 items) mainly investigated whether the materials used by students for learning were rich, as well as the purpose and degree of use of the materials. Fifth, course activities and interaction (4 items) mainly examined the interactive situation of students' online learning during and after class. Sixth, course production (3 items) mainly examined whether resources

such as course videos were readable and interesting, easy to use, and attractive. The scale was a 5-point Likert scale (1 = very non-conforming, 2 = non-conforming, 3 = uncertain, 4 = conforming, 5 = very conforming).

The results of the formal investigation showed that the KMO (Kaiser-Meyer-Olkin) values of all factors were above 0.70, so the sample is suitable for factor analysis (Kaiser, 1974). The factor load of the measured variables in the study were all above 0.68, which exceeded the standard of 0.4. Cronbach 'α values of all measured variables were above 0.829, higher than the standard of 0.7, showing a fairly high level of reliability (Nunnally, 1978). The analysis results are shown in Table 2.

Table 2. Exploratory Factors and Reliability Analysis of Measurement Variables

Item	Course overview	Course objectives	Learning assessment	Course materials	course activities and interaction	Course production
1	.736	.746	.684	.719	.723	.740
2	.748	.757	.713	.719	.742	.753
3	.761	.766	.736	.689	.719	.744
4	.732		.713	.702	.739	
EV	2.977	2.268	2.847	2.829	2.923	2.237
VE (%)	74.432	75.615	71.167	70.720	73.076	74.568
KMO	.840	.727	.827	.827	.831	.723
Bartlett's Test of Sphericity X ²	10322.006 ***	5742.119 ***	8835.612 ***	8622.814 ***	9702.466 ***	5399.912 ***
Cronbach'α	.885	.839	.865	.862	.877	.829

Online Learning Satisfaction Scale for Students

The online learning satisfaction scale used in this study was adapted from the scales of Kuo, Walker, Schroder, and Belland (2014) and Gong, Han, Wang, Gao, and Xiong (2016). The scale consisted of 6 items and was a 5-point Likert scale (1 = very dissatisfied, 2 = dissatisfied, 3 = generally, 4 = satisfied, 5 = very satisfied). In order to ensure the accuracy of the revised scale in expression, five professors with doctoral degrees in education who are specialized in student evaluation in universities were invited to revise the scale items. For example, according to the research purpose of

this paper, the expression of “online learning” in the original questionnaire was changed to “online course learning”.

Therefore, the content of the scale was whether the courses meet the needs of learners, their personal development needs, their academic development needs, their willingness to participate in online courses again, their interaction level with the courses, and their overall satisfaction with online learning.

In order to ensure the reliability and validity of the revised questionnaire, 100 students were randomly selected for preliminary survey. The formal results showed that KMO (Kaiser Meyer Olkin) = 0.914, which was higher than the standard value (0.5), Bartlett test $\chi^2 = 23411.006$ ($p < .001$), indicating that the variables were relatively independent. The factor loading is $0.724 \sim 0.786$ (≥ 0.4), the commonality was $0.851 \sim 0.887$ (≥ 0.4), the eigenvalue was 4.545 (≥ 1.0), and the Cronbach's α was 0.934 (≥ 0.7), all exceeding the standard value. This indicates that the scale has high reliability.

Table 3. Exploratory Factors and Reliability Analysis of Online Learning Satisfaction

Factor	Item	λ	C	EV	VE	Cronbach's α
Online learning satisfaction	S1	.882	.778	4.545	75.756	.934
	S2	.887	.786			
	S3	.877	.770			
	S4	.864	.747			
	S5	.861	.741			
	S6	.851	.724			

KMO: .914; Bartlett's Test of Sphericity: $\chi^2 = 23411.006$ ($p < .001$). Total Variance Explained: 75.756

Data Analysis

In order to analyze the differences of learning satisfaction and perceived quality of online course among college students and explore the relationship between the both variables, the collected data were analyzed by SPSS 22.0. Firstly, the demographic

characteristics of the collected data were analyzed, and the reliability and validity of the questionnaire were tested. Secondly, the differences of satisfaction and perceived quality of online course among participants were analyzed. Finally, correlation and hierarchical regression analysis were used to explore the relationship between the dimensions of perceived quality and learning satisfaction. In particular, the hierarchical regression is used to determine the relative influence of independent variables affecting the dependent variable (Lee & Huang, 2019). As a result, independent variables having a high degree of influence on the dependent variable can be identified step by step (Kim & Kang, 2020).

In sum, the analysis methods included frequency analysis, t-test, analysis of variance, correlation analysis, and hierarchical regression analysis.

Research Results

Descriptive Statistical Analysis

In this study, the mean value, standard deviation, skewness and kurtosis of the measured variables were used to judge whether the collected data were normally distributed. In general, the absolute value of skewness is less than 2.00, and the absolute value of kurtosis is not more than 7, which meets the requirements (Kline, 2015). The analysis results in Table 4 show that this is in line with the judgment criteria.

Overall, the mean values of all seven variables are greater than 3, and the overall perception is high. Among them, the average value of “course overview” is 4.00, which is higher than others, indicating that teachers pay more attention to the introduction of course overview in online course. However, the average value of “online learning satisfaction” was lower than that of other factors, which showed that students' satisfaction with online learning was lower than the overall perceived

quality, indicating that there is still a process of adaptation for large-scale online course. The skewness coefficient of all measurement items was negative, showing a slightly left skewness distribution, which indicates that most students have a higher perception of online course quality.

Table 4. Descriptive Statistics of Observed Variables

Factor	Min	Max	M	SD	Skewness	Kurtosis
Course overview	1.00	5.00	4.00	.603	-.396	.496
Course objectives	1.00	5.00	3.90	.587	-.371	.548
Learning assessment	1.00	5.00	3.89	.594	-.335	.409
Course materials	1.00	5.00	3.88	.600	-.437	.777
Course activities and learner interaction	1.00	5.00	3.92	.588	-.409	.653
Course production	1.00	5.00	3.83	.620	-.404	.671
Online learning satisfaction	1.00	5.00	3.66	.726	-.531	.723

Difference Analysis

Analysis of Differences by Gender

In this study, gender was used as a grouping variable, and students' perceived online course quality and learning satisfaction were used as testing variables to conduct independent sample *t*-test. The results are shown in Table 5. The results showed that there was no difference between male and female in the perceived quality of learning assessment, course materials and course production.

However, there were differences in the perceived quality of course overview ($t=4.385, p<.001$), course objectives ($t=-2.154, p<.05$) and course activities and learner interaction ($t=-2.205, p<.05$).

Looking at the mean values of course quality factors with significant differences in Table 5, it was found that male students had lower perceived quality than female students in these three course quality factors.

Table 5. Analysis of Differences by Gender

Factor	Male M (SD)	Female M (SD)	<i>t</i>
Course overview	3.89 (.668)	4.01 (.591)	-4.385***
Course objectives	3.85 (.660)	3.91 (.575)	-2.154*
Learning assessment	3.86 (.646)	3.89 (.586)	-1.294
Course materials	3.85 (.662)	3.89 (.591)	-1.265
Course activities and learner interaction	3.86 (.647)	3.92 (.578)	-2.205*
Course production	3.81 (.698)	3.84 (.607)	-1.028
Online learning satisfaction	3.68 (.784)	3.65 (.717)	.844

* $p < .05$, ** $p < .01$, *** $p < .001$

Analysis of Differences by Grade

In this study, one-way ANOVA analysis was conducted with students' grade as independent variable and perceived online course quality and learning satisfaction as the dependent variables. The results are shown in Table 6. Students of different grades have differences in perceived quality of course overview ($F=4.893$, $p < .01$), course objectives ($F=5.270$, $p < .01$), learning assessment ($F=6.119$, $p < .01$) and course materials ($F=3.044$, $p < .5$). There was no significant difference in perceived quality of course activities and learner interaction and course production. In addition, there is no significant difference in students' satisfaction with online learning among different grades.

Table 6. Analysis of Differences by Grade

Factor	Grade 1 M (SD)	Grade 2 M (SD)	Grade 3 M (SD)	F	LSD
Course overview	4.04 (.618)	3.97 (.571)	3.99 (.618)	4.893**	a>b, a>c
Course objectives	3.94 (.608)	3.88 (.557)	3.88 (.595)	5.270**	a>b, a>c
Learning assessment	3.93 (.627)	3.87 (.557)	3.87 (.596)	6.119**	a>b, a>c
Course materials	3.91 (.624)	3.88 (.561)	3.85 (.616)	3.044*	a>c
Course activities and learner interaction	3.94 (.607)	3.91 (.551)	3.90 (.605)	1.745	
Course production	3.84 (.648)	3.82 (.579)	3.84 (.633)	.512	
Online learning satisfaction	3.67 (.766)	3.64 (.691)	3.67 (.720)	1.089	

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: a is grade 1, b is grade 2, c is grade 3

Analysis of Differences in Learning Hours

In this study, one-way ANOVA analysis was conducted with learning hours as independent variable and students' online learning satisfaction as dependent variable. The results are shown in Table 7.

Table 7. Analysis of Differences in Learning Hours

Factor	Above 12h M (SD)	8h-12h M (SD)	4h-8h M (SD)	Below 4h M (SD)	F
Online learning satisfaction	3.23 (1.030)	3.80 (.704)	3.68 (.670)	3.31 (.883)	64.950***

* $p < .05$, ** $p < .01$, *** $p < .001$

Different online learning hours have significant difference in online learning satisfaction ($F=64.950, p < .001$). Students who spend 8 to 12 hours in online learning every day have the highest mean score of learning satisfaction, followed by 4 to 8 hours ($M=3.68$), followed by below 4 hours ($M=3.31$). And the learning hours of students with lowest learning satisfaction was above 12 hours.

In order to further understand the difference between learning hours and students' satisfaction with online learning, this study conducted multiple comparative analysis by using LSD method. The results showed that there was no significant difference in

Table 8. Multiple Comparisons of Online Learning Satisfaction in Different Learning Hours (LSD)

Factor	learning duration	I-J	Significance	95% Confidence interval	
				Lower limit	Upper limit
Online learning satisfaction	above 12h & 8h-12h	-.56092***	.000	-.6886	-.4332
	above 12h & 4h-8h	-.44382***	.000	-.5664	-.3212
	above 12h & below 4h	-.07587	.278	-.2130	.0613
	8h-12h & 4h-8h	.11710***	.000	.0672	.1670
	8h-12h & below 4h	.48506***	.000	.4059	.5642
	4h-8h & below 4h	.36796***	.000	.2973	.4386

* $p < .05$, ** $p < .01$, *** $p < .001$

online learning satisfaction between learning hours of above 12 hours and below 4 hours, and there were significant differences in online learning satisfaction among other learning hours, as shown in Table 8.

Correlation Analysis

In this study, the correlation between the two variables was analyzed before examining the effect of the independent variable on the dependent variable. The result was shown in Table 9. In the table, all variables showed positive correlation at a statistically significant level ($p < .01$).

Table 9. Correlation Analysis

Factor	1	2	3	4	5	6
F1	1					
F2	.773**	1				
F3	.754**	.821**	1			
F4	.718**	.770**	.820**	1		
F5	.726**	.780**	.818**	.832**	1	
F6	.679**	.737**	.771**	.788**	.808**	1
S	.632**	.684**	.728**	.741**	.776**	.801**

** $p < .01$

Note: F1 (Course overview), F2 (Course objectives), F3 (Learning assessment), F4 (Course materials), F5 (Course activities and learner interaction), F6 (Course production), S(Online learning satisfaction)

Hierarchical Regression Analysis of Students' Perceived Course Quality and Online Learning Satisfaction

In order to find out the influence of various factors of online course quality on learning satisfaction, the hierarchical regression analysis method was adopted. Six groups of variables, such as course overview, course objectives, learning assessment, course materials, course activities and learner interaction, and course production, were entered into the regression equation in order to analyze the results of each

influencing relationship. The results are shown in Table 10.

Model 1 shows that course overview has a significant positive impact on online learning satisfaction, indicating that clear course introduction can improve learning satisfaction. Model 2 shows that the course overview and course objectives have a significant positive impact on online learning satisfaction after adding course objectives perception variable, indicating that clear course objectives and course introduction can improve learning satisfaction.

Table 10. Hierarchical Regression Analysis of Online Learning Satisfaction

Factor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
F1	.632***	.255***	.116***	.058***	.017	.000
F2		.488***	.210***	.123***	.056**	.011
F3			.468***	.268***	.154***	.089***
F4				.385***	.212***	.101***
F5					.418***	.259***
F6						.437***
DW	2.007	2.000	1.991	1.979	1.981	1.971
F	3192.497***	2353.136***	2025.390***	1812.158***	1726.848***	1844.017***
R2	.399	.495	.558	.601	.642	.697
Adj. R2	.399	.494	.558	.601	.642	.697

* $p < .05$, ** $p < .01$, *** $p < .001$

Note: F1 (Course overview), F2 (Course objectives), F3 (Learning assessment), F4 (Course materials), F5 (Course activities and learner interaction), F6 (Course production)

Model 3 shows that course overview, course objectives and learning assessment have a significant positive impact on online learning satisfaction after adding the perceived variable, learning assessment. By comparing the regression coefficients of the three variables, it can be seen that learning assessment has the greatest impact on learning satisfaction ($\beta = 0.468$). It also shows that learning assessment plays a major role in learning satisfaction. Reasonable assessment helps learners master knowledge. In other words, online course needs to arrange assessment reasonably. Model 4 shows that course overview, course objectives, learning assessment and course materials have a significant positive impact on online learning satisfaction. By comparing the regression coefficients of the four variables, we can see that the

significant coefficient of course materials on online learning satisfaction is the largest ($\beta = 0.385$). It shows that reasonable assessment and appropriate teaching resources can better improve online learning satisfaction. Model 5 shows that course objectives, learning assessment, course materials and course activities and learner interaction have a significant positive impact on online learning satisfaction, but the impact of course overview on online learning satisfaction is no longer significant. Comparing the regression coefficients of the four variables, we can see that the significant coefficient of course activities and learner interaction on online learning satisfaction is the largest ($\beta = 0.418$). It shows that strengthening the course activities and learner interaction can better improve online learning satisfaction. Model 6 shows that after adding the perception variable of course production, learning assessment, course materials, course activities and learner interaction, and course production have a significant positive impact on online learning satisfaction, while the impact of course overview and course objectives on online learning satisfaction is no longer significant. Comparing the regression coefficients of the four variables, we can see that the significant coefficient of course production on learning satisfaction is the largest ($\beta = 0.437$). This also shows that the quality of course production plays a major role in online learning satisfaction. Improving the level of course production is the most effective way to improve students' online learning satisfaction.

Discussion and Conclusions

Based on data from students who participated in online learning at a university, this research analyzed the differences between the perceived course quality and online learning satisfaction of students of different grades and genders, and explored the influence of various factors of students' perceived online course quality on learning satisfaction. The following is a discussion and conclusions.

First, research showed that there was no difference in online learning satisfaction

among students of different grades and genders. However, students of different grades and genders have different perceptions of course quality. Among them, male and female have no difference in the perceived quality of learning assessment, course materials, and course production, but there are different degrees of differences in the course overview, course objectives, and course activities and learner interaction. Students of different grades have differences in the perceived quality of course overview, course objectives, learning assessment, and course materials, but there are no significant differences in the perceived quality of course activities and learner interaction and course production. These results are linked to a study by Che (2021) that explored strategies for improving online learning satisfaction in higher education. According to that research, in online learning, the composition of an environment in which learners can explore themselves is the first strategy to improve learning satisfaction (Che, 2021). On this account, it can be said that a clear perception of the course is important for online learners to engage in self-directed learning activities. Therefore, it can be said that systematic efforts are needed to strengthen students' perception of course overview and objectives, which showed common differences by gender and grade in this study.

Second, the regression analysis showed that learning assessment, course materials, course activities and learner interaction, and course production have a significant positive impact on online learning satisfaction, which is consistent with previous studies (Li et al., 2020; Ralston-Berg et al., 2015; Yang & Wang, 2020). At the same time, regression analysis showed that course overview and course objectives had no significant impact on online learning satisfaction. The data showed that when only the four factors of course overview, course objectives, learning assessment and course materials were considered, all these factors had a positive and significant impact on students' satisfaction with online learning. When the factors of course activities and learner interaction are included, course overview and learning satisfaction show no significant impact, while learning objectives still show significant impact on online learning satisfaction. However, when the factors of course

production are added, the course overview and course objectives have no significant impact on learning satisfaction. It can be seen that the satisfaction of online teaching depends to a greater extent on course production and interaction of online teaching. This also suggests to teachers that if teachers can provide more learning resources for online learners and the resources can be accessible without barriers, students' online learning satisfaction will generally be improved. At the same time, if teachers can combine the characteristics of the courses and students to design course activities, and encourage students to participate in the interaction, students' learning satisfaction will be higher.

Third, by comparing the regression coefficients of all variables in the final regression model, the total effect of influencing students' online learning satisfaction was as follows. Course production had the greatest effect, followed by course activities and student-student interactions, followed by course materials. It was the learning assessment that showed the least effect. Course production is the most influential factor to improve students' online learning satisfaction. Therefore, in order to improve the satisfaction of online learning, teachers can take improving the level of course production as the key point. That is, teachers need to know how to produce rich and readable course resources, using easy-to-use course navigation to ensure that course resources are easily accessible to learners. At the same time, it is necessary to enhance the interaction between teachers and students through the design of a variety of curriculum activities and to guide students to learn independently to build their own knowledge system by interaction. Online course interaction should expand the scope of interaction. The objects of students' interaction should not only include teachers and classmates, but also include experts, learning platforms and applied learning tools (Hanna, Glowacki-Dudka, & Conceigao-Runlee, 2000). In short, resource production, resource sharing, interactive learning, etc. should become the key link to improve online teaching satisfaction.

Finally, there are two main limitations of this study. One is that it did not consider the technical support of students' online learning. In practice, technical support is

also an important factor in online learning, so future studies need to consider this. The other is that this study relies on a survey of students from a certain university. Of course, this research has been conducted on most students at the university, but it does not fully represent the current situation of online learning of all different types of university students. These should be made up for in the future research.

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