

The Influence of UTAUT Factors on Students' Online Learning Satisfaction in Normal University of Liaoning Province, China

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Abstract: *This study investigates the factors influencing online learning satisfaction among university students in Liaoning Province using the Unified Theory of Acceptance and Use of Technology (UTAUT) framework, including performance expectancy, effort expectancy, social influence and facilitating conditions. A quantitative approach was adopted, and a survey was conducted among 105 undergraduate students from three normal universities in Liaoning Province. The results show that performance expectancy, effort expectancy and facilitating conditions have a significant impact on online learning satisfaction, with performance expectancy being the most influential factor. In contrast, social influence did not have a significant effect, suggesting that external perceptions may not play a key role in immediate satisfaction. This study highlights the importance of a user-friendly platform, adequate technical support and course relevance in improving the learning experience. These findings provide actionable insights for educators and policymakers to improve digital learning environments and address satisfaction differences across regions.*

Keywords: online learning satisfaction, performance expectancy, effort expectancy, social influence, facilitating conditions

1. Introduction

The Chinese government has vigorously developed digital education in recent years, and information technology has promoted the development of high-quality education and provided a new direction for the development of higher education. By March 2024, China had built 27,000 high-quality online courses for higher education with over 100 million registrations (Chinese Ministry of Education, 2022). Online learning not only gives more people access to learning opportunities, but also promotes the sharing of teaching resources. Through the e-learning platform, high quality programs in developed regions are shared with university students in less developed regions under national coordination, thereby improving the quality of local education and training and the quality of talent development (Chinese Ministry of Education, 2024). However, with the rapid development of online learning in Chinese higher education, a number of problems have emerged, the most important of which is students' satisfaction with online learning. Students' satisfaction with online learning reflects, to a certain extent, the teaching quality and learning effect of online learning (Chen, 2022). Previous researchers have selected different groups of university students at different times to conduct surveys, and the results show that Chinese university students' satisfaction with online learning is basically at a "passing" level (Hu, 2023, Yuan & Liu, 2022).

Digitalisation of education is both an effective way to improve the quality of education and an important support for building a learning society. The Report of the 20th National Congress of the Communist Party of China puts “promoting the digitalisation of education” before “building a learning society and a learning nation with lifelong learning for all”, indicating that digitalisation is an important method and way to achieve the construction of a learning society (He, 2023). Online learning is a new type of learning mode based on mobile Internet technology, providing learners with rich learning resources and personalised learning services. Learners can learn at any time according to their needs, and they can also interact with each other in the process of online learning. There are several ways to categorise online learning. However, the majority of researchers agreed that online learning can be generally divided into two main types: synchronous and asynchronous learning (G Padaguri & Akram Pasha, 2021). The popularity of online learning has changed the traditional way of learning, especially by escaping from the constraints of time and space, and has gradually evolved into a mode of learning that combines physical environments and digital resources (Chen, 2021).

Unlike traditional learning, the information-based online learning model placed the student at the centre of the learning process, whereby the students became an active acquirer of information rather than a passive receiver (Tian, 2023). It is therefore essential to investigate students’ levels of satisfaction with online learning. As a result, many models and theories have been developed to predict the acceptance of new educational technologies by students. One of the most widely used research models is the unified theory of acceptance and use of technology (UTAUT) proposed by Venkatesh et al (2003). Some researchers discovered that UTAUT has the upper power compared to other similar models and theories in the field of explaining users’ IT acceptance (Almaiah et al., 2019). The UTAUT theory suggests that the core variables of performance expectations, effort expectations, social influence and facilitating conditions will have an impact on students’ usage of educational technology (Li, 2023). Students’ satisfaction with online learning is closely related to their acceptance of online learning technologies (Wang et al., 2021).

Students’ satisfaction with online learning is an important measure of the effectiveness and quality of online learning (Ma, 2023). Studying the current levels of university students’ satisfaction with online learning and the factors influencing it will help university teachers, university administrators and educational policy makers to identify problems and find solutions accordingly. At present, there is limited research on the effects of performance expectancy, effort expectancy, social influence and facilitating conditions on university students’ satisfaction with online learning. Therefore, this study aims to examine the relationship between performance expectancy, effort expectancy, social influence, facilitating conditions and online learning satisfaction among university students in Liaoning Province, China, as well as the moderating effect of students’ major on the relationships between these variables.

A survey of 334 colleges and universities in different regions of China by Professor Wu Daguang’s team found that less than 55% of students were satisfied or very satisfied with online learning (Wu, 2020). The results of a survey conducted by the Chinese Network of Internal Quality Assurance Agencies in Higher Education (CIQA) indicated that 17.97% of students were highly satisfied with their online learning experience, while another 51.37% respondents expressed satisfaction with their online learning (News.qq.com, 2020). Yuan Haonan and Liu Meiyi’s (2022) study found that students in normal universities had an average satisfaction score of 2.46 out of 5 for online learning.

Universities in different geographic regions have differences in information technology teaching foundation, teachers' information technology teaching ability and online learning support services, which will have an important impact on university students' online learning (Wang & Jin, 2022). However, research on online learning satisfaction among university students in Liaoning Province is very limited. Universities in different geographic regions have differences in information technology teaching foundation, teachers' information technology teaching ability and online learning support services, which will have an important impact on university students' online learning (Wang & Jin, 2022). However, research on online learning satisfaction among university students in Liaoning Province is very limited.

2. Literature Review

2.1 Previous Studies on Online Learning Satisfaction

With the widespread application of online learning, more and more teachers and researchers have started to pay attention to students' satisfaction with online learning, which can provide important clues for teachers' online teaching arrangements (Li et al., 2023), and can help teachers identify problems in online teaching and improve the quality of online teaching in a timely manner (Chu, 2021). In addition, the understanding and improvement of student satisfaction with online learning is an important driver for online learning (Chen, 2023).

The researcher used Web of Science to search for relevant studies between 2020 and 2024 on the topic of "students online learning satisfaction". After deduplication and deletion of invalid data, the researcher conducted keyword cluster analysis on the 292 valid data obtained and the results are shown in Figure 1.

Geographic Heatmap of Research on "Online Learning"

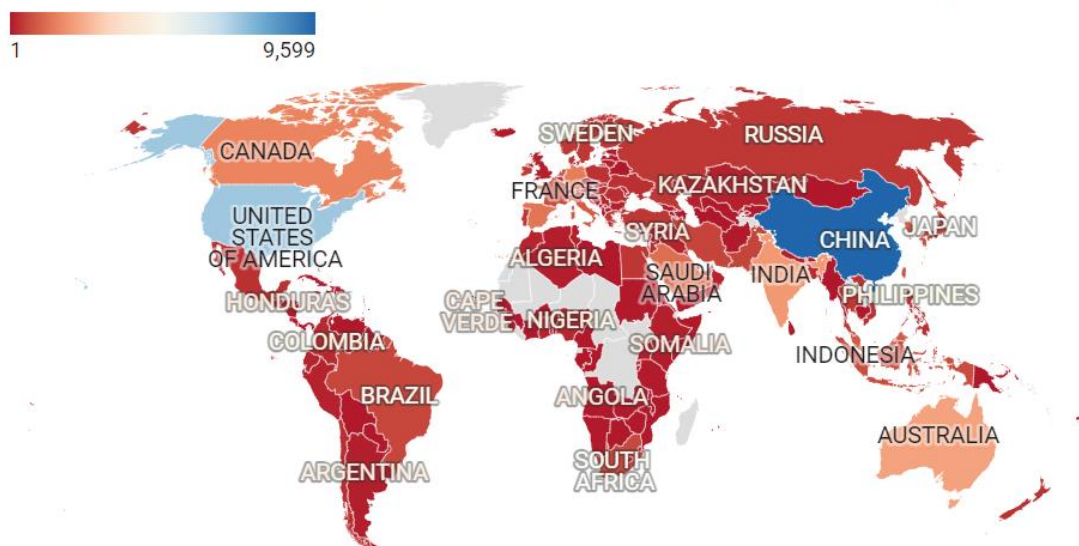


Figure 1: Geographic Heatmap of Research on "Online Learning" (2022-2024)

As shown in Figure 2, most research on students' satisfaction with online learning focuses on their continuance intention. A key indicator of online learning outcomes is learners' continuance intentions (Liu & Pu, 2023). Some researchers have cited students' initial acceptance and use of online learning technologies as an important measure of online learning (Kong et al., 2023; Rouidi et al., 2022; Tussardi et al., 2021), and many others have cited students' online learning usage rate and learning hours as a primary evaluation metric (Peng,

2022; Wang& Jin, 2022). However, it is students' continuance intention towards the usage of online learning that is the essential factor in evaluating the success of online learning (Chauhan et al., 2022; Marandu et al., 2023; Taghizadeh et al., 2022).

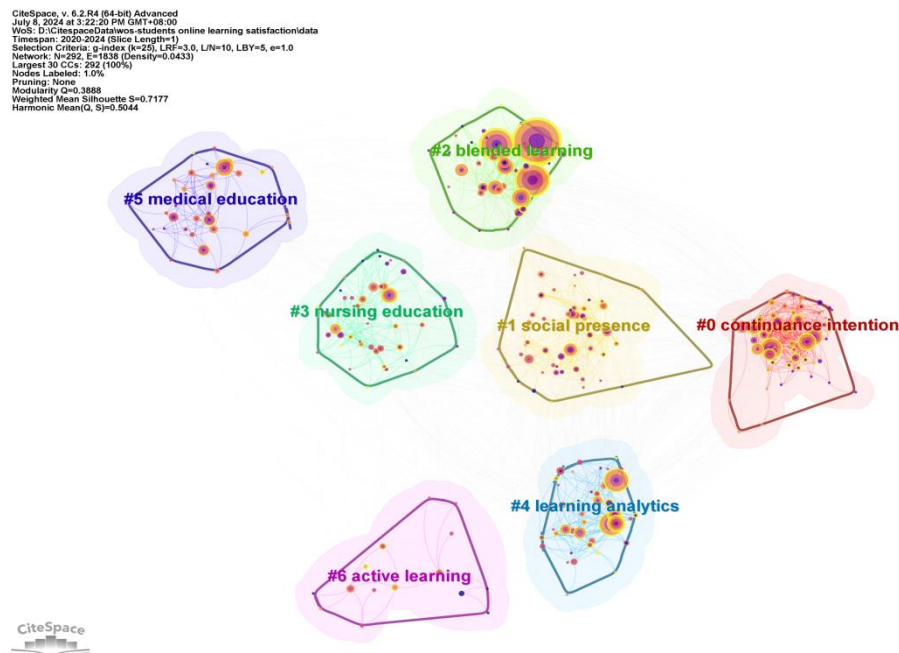


Figure 2: Cluster Analysis of Keywords “Students Online Learning Satisfaction”

2.2 The Unified Theory of Acceptance and Use of Technology (UTAUT)

In today's society, more and more information technology has been invented to improve the efficiency of production and life, however, these technologies can only reflect their value if they were accepted, applied and used consistently in real life. Therefore, one of the most important issues in the field of science and technology today is the study of people's adoption and application of information technology (Zhang & Sun, 2010). As mentioned above, although the TAM model has also evolved and improved, it still has certain problems. In order to address the shortcomings of the TAM model and to better study IT acceptance, Venkatesh et al. (2003) proposed the unified theory of acceptance and use of technology (UTAUT) model by combining the core concepts of eight major theories and models. These eight theories included the theory of reasoned action (TRA), innovation diffusion theory (IDT), the theory of planned behaviour (TPB), the technology acceptance model (TAM), the combined TAM-TPB, the motivation model (MM), the model of PC utilisation (MPCU) and social cognitive theory (SCT). The integrated UTAUT model is able to better reflect user acceptance of information technology.

In the UTAUT model, the core influences of performance expectations, effort expectancy, facilitating conditions and social influence together with the four moderating variables, i.e., an individual's age, gender, experience and voluntariness, influence an individual's behavioural intentions to use and actual use behaviour (Liu, 2023). As shown in Figure 2.6, the four independent variables, under the influence of the moderating variables, directly or indirectly affect the individual's intentions to use and behavioural use.

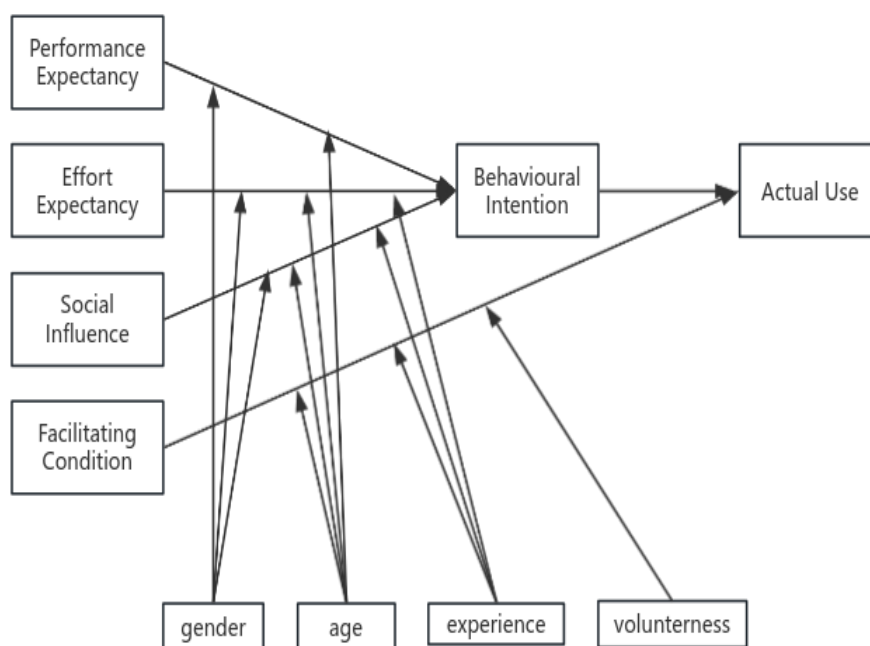


Figure 3: UTAUT Model

In recent years, the UTAUT model has been widely used as an important theory for research in the category of educational technology acceptance. In UTAUT model, individual's behaviour intentions were used to predict his or her acceptance of a technology (Venkatesh et al., 2003). According to Venkatesh et al. (2003), there were four factors that would influence individual's behavioural intention. They were performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC).

Performance expectancy was the extent to which users perceive the technology to be helpful to them. Students' performance expectancy is the effectiveness and usefulness of the use of mobile apps to assist language learning as perceived by students in improving their English grades and English proficiency (Yang et al., 2023). Generally speaking, when users' performance expectancy was satisfied, they would have a greater intention to use a technology. Liu Yingdong (2023) suggested the need for nationally coordinated planning to improve the quality of online education, including the mutual recognition of credits in online education at home and abroad, the collaborative development and construction of teaching platform resources, and increasing the diversity, selectivity and relevance of online learning programmes to meet the online learning needs of different students.

Effort expectancy is the degree of difficulty in using the new technology. Integrating mobile technology into learning, effort expectancy can be defined as the ease or difficulty of using mobile technology in the learning process (Alghazi et al., 2023). Previous studies supported that effort expectancy greatly influenced individual's intention to adopt mobile technology or mobile service. In other words, effort expectancy had a significance influence on users' intention toward mobile-learning. That means that most users treated m-learning systems as a easy technology to use (Wang et al., 2008).

Social influence and facilitating conditions, on the other hand, reflect the attitudes of the people around the user (mainly those who were important and influential to the individual) towards a technology and the support and assistance that can be provided. When examining student acceptance of educational technology, the attitudes of teachers and surrounding peers were

often viewed as the primary form of social influence (Shao, 2022). From a more macro perspective, national policies and regulations can also be seen as a social influence. If the researcher wants to promote university students' acceptance and use of online education platforms, the researcher needs to formulate relevant laws and regulations, etc., so as to provide a strong institutional guarantee for students' learning and to increase the country's social influence on online education (Liu, 2023). Therefore, each individual can be part of the social influence, influencing others' attitudes towards IT with their own attitudes and behaviours.

To increase learners' actual intentions and behavioural use of educational technology, they need to be supported and facilitated accordingly. To enhance students' mobile learning experience, firstly, it is necessary to build high-quality learning resources, and secondly, it is necessary to pay attention to the operation of mobile learning applications and improve the level of financial aid support services (Wang et al., 2021). According to previous studies, facilitating conditions include both hardware and software conditions. Typically, a device condition refers to a device to which a certain technology can be applied, such as a smartphone, a personal computer, a network, and so on. Software conditions include equipment-related technical support, after-sales service, training in the use of skills, and professional guidance when problems were encountered (Li, 2020).

2.3 Research Model

This study is based on the UTAUT model to study university students' satisfaction with online learning. Therefore, this study includes a total of four independent variables: performance expectancy, effort expectancy, social influence and facilitating conditions, and one dependent variable: satisfaction with online learning. Therefore, this study proposes a research model as shown in Figure 4.

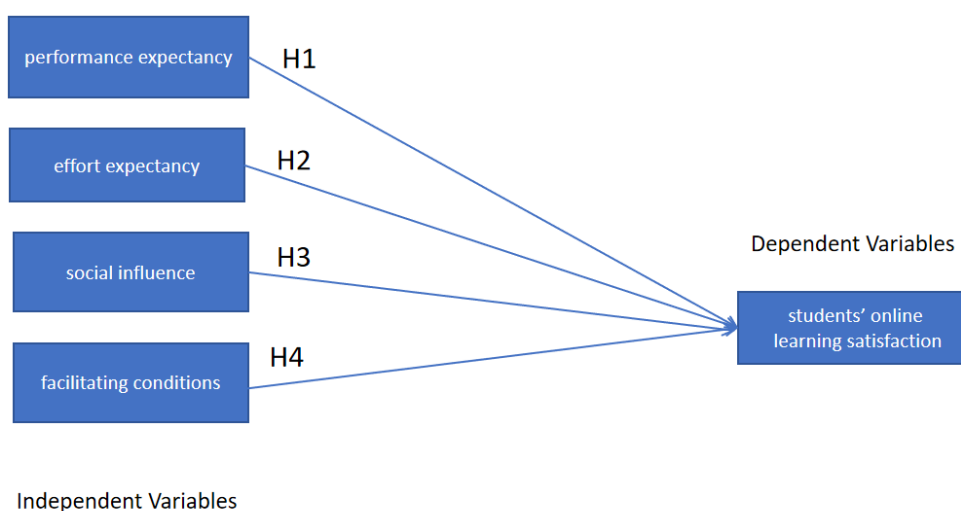


Figure 4: Research Model

3. Research Methodology

3.1 Research Setting and Respondents

This study adopted a quantitative approach. The aim of this study was to investigate the impact of performance expectancy, effort expectancy, social influence and facilitating conditions on university students' satisfaction with online learning. A stratified random sampling method

was used in this study to select 105 undergraduate students from three normal universities in Liaoning Province. The specific information of the 105 respondents is shown in Table 1.

Table 1: Descriptive statistics of respondents

Items	Type	Frequency	Percentage
Gender	Male	23	21.9
	Female	82	78.1
Age	18 and below	5	4.8
	19-22	82	78.1
	23 and above	18	17.1
Grade	1 year	5	4.8
	2 year	22	21.0
	3 year	35	33.3
	4 year	43	41.0
Major	Natural Sciences	32	30.5
	Humanity and Social Sciences	73	69.5

3.2 Research Instruments

This study used a 5-point Likert scale to measure performance expectations, effort expectancy, social influence, behavioural intentions and actual use behaviour. In the questionnaire, each question has 5 different options. From strongly disagree to strongly agree, each was assigned a score of 1-5 in the study. The 5-point scale was neither disturbing to the subjects because of too many options nor too few options to choose from. Likert scales are also a common form of questionnaire used in social science research.

Of the 5-point questions related to the variables of this study, the research instruments used to study students' performance expectancy and facilitating conditions aspects were adapted from the original research instruments made by Venkatesh et al. (2003). The research instrument used to investigate students' effort expectancy towards online learning was adapted from the study of Chao (2019), the instrument of social influence is adapted from the study by Marchewka and Kostiwa (2014), and the instrument of students' online learning satisfaction was adapted from the questionnaire of Sun et al. (2008). The research instruments mentioned above were constructed with close-end questions. Both of these research instruments were based on the study of educational technology, and the context and purpose of the study were relatively close to this dissertation, thus making them highly informative.

3.3 Data Collection and Analysis

To collect the data, the researcher distributed the questionnaire to the respondents via the Internet and provided a detailed explanation of the collected questionnaire information. All quantitative data collected from the questionnaires were analysed using descriptive statistics in SPSS 27. The data is presented as percentages and frequencies. Next, the data from the individual scales of the questionnaire was analysed preliminarily and converted into mean scores to understand students' satisfaction with online learning. Finally, a correlation analysis was conducted between the variables to understand the impact of performance expectancy, effort expectancy, social influence and facilitating conditions on university students' satisfaction with online learning.

In this study, we used a structural equation model (SEM) to test the structural relationships between four independent variables and satisfaction with e-learning. To analyse the SEM, the researchers first conducted a reliability analysis of the questionnaire based on Cronbach's Alpha coefficient. They then assessed the validity of the measurements using convergent and discriminant validity analysis. After that, the model fit indices of the research model were

assessed using confirmatory factor analysis (CFA). Finally, the proposed hypotheses were tested using path analysis and the path coefficients between the variables in the structural model were analysed.

4. Findings

4.1 Reliability and validity analysis

Reliability tests are used to measure the reliability of data and to test the stability and consistency of questionnaire data. In this study, Cronbach's α was used to test the internal consistency of the questionnaire data, and its coefficient ranges from 0 to 1. Generally speaking, a coefficient greater than 0.7 indicates that the questionnaire can pass the internal consistency test. Conversely, a coefficient less than 0.7 indicates that some questions must be discarded. The results of the reliability test are shown in Table 2. In this questionnaire, the six Cronbach's α coefficients are all greater than 0.7, indicating that the internal reliability of each primary indicator in the questionnaire is high.

Table 2: Reliability Analysis

Variables/Dimensions	N of Items	Cronbach's α
Perceived Usefulness	4	.828
Perceived Outcome	4	.794
Effort Expectancy	5	.829
Social Influence	5	.842
Perceived Behaviour Control	4	.798
Perceived Facilitating Conditions	3	.829
Students' Online-learning Satisfaction	9	.852
Total	34	.832

In this case, KMO can be used to test the adequacy of the sample size of the data, and BTOS can be used to test the distribution of the data, as well as the independence between the variables (Costales et al., 2022). In general, if the KMO value is greater than 0.50, the factor analysis technique can continue to be used (Iskandar & Ishak, 2023). In the Bartlett's test of sphericity experiment, when the p-value is less than 0.05, it indicates that the data set is significantly suitable for factor analysis (Hamed et al., 2014). As shown in Table 3, all scales in this study have a KMO greater than 0.5 and a significance level of less than 0.05.

Table 3: Validity Analysis

Index	KMO	Bartlett Test of Sphericity
Performance Expectancy	.787	.000
Effort Expectancy	.767	.000
Social Influence	.837	.000
Facilitating Conditions	.743	.000
Online Learning Satisfaction	.892	.000

4.2 Discussion of Research Hypotheses

The results of the regression analysis demonstrate a strong and significant relationship between the independent variables (Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions) and the dependent variable (Online Learning Satisfaction). The Model Summary table reveals an R^2 value of 0.596, indicating that 59.6% of the variance in LS is explained by the predictors.

The Adjusted R^2 value of 0.580 confirms the model's robustness when accounting for the number of predictors. The ANOVA table highlights the overall significance of the regression

model with an F-value of 36.932 and a p-value below 0.001. This confirms that the model significantly predicts the dependent variable.

From the Coefficients table, performance expectancy ($B = 0.521$, $p < 0.001$) is the most significant predictor, contributing the highest standardized coefficient ($\beta = 0.504$). Effort expectancy ($B = 0.193$, $p = 0.033$) and FC ($B = 0.276$, $p = 0.008$) are also significant predictors, though with smaller effects. Social Influence, however, is not significant ($B = 0.048$, $p = 0.561$), indicating minimal influence on online learning satisfaction. Collinearity diagnostics suggest that multicollinearity is not a major concern, with all Variance Inflation Factor (VIF) values below 2 and tolerances above 0.1. However, Condition Indices above 15 for dimensions 2 to 5 indicate moderate collinearity among some predictors, which may slightly impact coefficient stability. Overall, the regression model effectively identifies the key drivers of online learning satisfaction, with performance expectancy emerging as the most influential factor.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	-.003	.353		-.008	.994		
PE	.521	.089	.504	5.876	.000	.549	1.821
EE	.193	.089	.179	2.165	.033	.589	1.697
SI	.048	.082	.044	.583	.561	.696	1.436
FC	.276	.102	.207	2.711	.008	.695	1.439

a. Dependent Variable: LS

The focus of this study is to identify the factors in the UTAUT model that may affect college students' satisfaction with online learning. Our study also aims to identify the factors that may have the greatest impact on college students' satisfaction with online learning. According to the research results, performance expectations, effort expectations, and facilitating conditions all have a significant impact on college students' satisfaction with online learning. This is consistent with the results of related studies on technology acceptance and online learning satisfaction (Sang, 2023; Pham & Dau, 2022; Wut et al., 2022; Ejdy, 2022). The results of the study showed that social influence had no significant effect on college students' online learning satisfaction, which is contrary to the results of previous studies (Wut et al., 2022; Kosiba et al., 2022).

In this study, performance expectancy is the factor that has the greatest impact on college students' satisfaction with online learning. Performance expectancy in this study refers mainly to college students' perceived usefulness and perceived results of using online learning. In other words, performance expectancy refers to the extent to which students' use of online learning helps their theoretical knowledge, technical skills, and practical abilities. Previous studies have shown that the higher the degree to which students' performance expectations are met, the higher their satisfaction with online learning (Palmer & Holt, 2009). In addition, effective online course design can also increase students' performance expectations and ultimately positively affect their online learning satisfaction (Sang, 2023). The ultimate goal of college students using online learning is to help them improve their knowledge and skills, so performance expectancy becomes the most important factor affecting students' online learning satisfaction.

In addition to performance expectancy, effort expectancy and facilitating conditions also have a significant impact on college students' satisfaction with online learning. Effort expectancy,

that is, students' perception of the ease of use and convenience of using the online learning system, significantly affects their satisfaction with online learning (Pham & Dau, 2022). Research shows that ease of use of technology and a low learning curve can improve students' acceptance and satisfaction with the learning system. In addition, effort expectancy significantly affects students' intention to continue using the online learning system, and this intention is positively correlated with satisfaction (Wan et al., 2020). Students are more likely to feel satisfied and willing to continue using the learning system when they find it easy to use. Finally, effort expectancy is closely related to technology fit and system design quality. Students' effort expectancy is significantly enhanced when they feel that the system interface is intuitive and learning resources are easily accessible, which further increases satisfaction (Kosiba et al., 2022). Effort expectancy plays an important role in college students' online learning satisfaction. Students' positive perception of the usability of the learning platform can directly or indirectly enhance satisfaction by improving self-efficacy and learning outcomes. Therefore, the design of online education platforms should focus on the user experience and optimize system usability to enhance learner satisfaction.

Research has shown that facilitating conditions (such as fast internet, availability of computing devices, and mobile-friendly software) have a significant positive effect on students' satisfaction with online learning. These conditions reduce technical barriers and make it easier for students to focus on the content (Wut et al., 2022). Other studies have found that in the use of learning management systems (LMS), students believe that good facilitating conditions (such as a clearly navigable interface and user guides) can improve learning efficiency and significantly enhance learning satisfaction (Nasir et al., 2021). In addition, high-quality facilitating conditions significantly enhance student satisfaction and further predict their willingness to continue using the online learning system in the future (Ejdys, 2022). Facilitating conditions play an important role in college students' satisfaction with online learning. Good technical support and environmental conditions directly improve satisfaction. Therefore, universities and education platforms should prioritise optimising facilitating conditions, such as improving technical infrastructure and providing clear user guides, to improve student satisfaction and support long-term learning goals.

It is worth noting that this study found that social influence did not have a significant effect on students' satisfaction with online learning. Social influence in this study refers to the attitudes (supportive, encouraging or negative) of teachers, classmates, family members, etc., towards students' use of online learning. Some studies have found that students' satisfaction with online learning is more related to their own technological adaptability and learning experience (Kosiba et al., 2022). Other researchers have suggested that the effect of social influence in an online learning environment may be weakened by other factors, such as platform ease of use and facilitating conditions. Students rely more on technical support and course structure than on influences from peers or the community. These studies suggest that social influence may not be a key driver of individual technology use and satisfaction (Pham & Dau, 2022). Students rely more on technical support and course structure than on influences from peers or the community. These studies suggest that social influence may not be a key driver of individual technology use and satisfaction (Pham & Dau, 2022). Furthermore, students rely more on technical support and course structure than on influences from peers or the community. These studies suggest that social influence may not be a key driver of individual technology use and satisfaction (Pham & Dau, 2022). In addition, social influence may have an indirect effect on long-term learning intentions, but does not significantly affect immediate satisfaction. Research shows that satisfaction is more influenced by course design and learning content than by social networks or group pressure (Ejdys, 2022).

5. Conclusion

The main objective of this study was to investigate the influencing factors of college students' online learning satisfaction based on the technology acceptance model. The results show that students' online learning satisfaction is affected by performance expectancy (PE), effort expectancy (EE) and facilitating conditions (FC). In addition, students' online learning satisfaction is most affected by performance expectancy. This finding suggests that schools and society should improve students' online learning satisfaction by improving the quality of online courses, making the online learning platform easier to use, and strengthening online learning training and technical support.

However, the results also show that social influence does not have a significant impact on students' satisfaction with online learning. Although attitudes towards online learning, such as those of society, teachers and classmates, do not affect students' satisfaction with online learning, previous research has found that the impact of social factors on students' online learning behaviour and satisfaction with online learning may be long-term rather than immediate. Therefore, society and teachers should also encourage and support students' online learning behaviour.

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