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Investigating Key Factors Influencing Student Satisfaction in Online Learning for Construction Engineering Students in Guizhou, China

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Abstract

Purpose: This study explores the influencing factors of student satisfaction in online learning platforms in vocational colleges in Guizhou, China. The conceptual framework proposes causal relationships among computer self-efficacy, perceived ease of use, group participation, teachers' technical readiness, student engagement, students' self-efficacy, and student satisfaction. **Research Design, data, and Methods:** Researcher conducted a quantitative method to survey 500 students in three representative higher vocational colleges in Guizhou. Nonprobability sampling includes judgmental, quota, and convenient sampling. Structural Equation Model and confirmatory factor analysis were used to analyze the data, including model fit, reliability and structure validity. **Result:** The results showed that computer self-efficacy had a significant impact on students' perceived ease of use, perceived ease of use, teachers' technical preparation, students' self-efficacy, and students' involvement significant affect student satisfaction, while group participation had no significant impact on students' satisfaction when using online learning platforms. In addition, students' perceived ease of use has the greatest impact on their satisfaction, followed by students' self-efficacy, teachers' technical preparation, and students' input. **Conclusion:** It is recommended that management teams and teachers at vocational colleges provide assessments to measure the impact of the online platform on the development of teaching models to enhance students' satisfaction with online learning.

Keywords : Online Learning, Perceived Ease of Use, Student Engagement, Self-Efficacy, Satisfaction

JEL Classification Code: E44, F31, F37, G15

1. Introduction

In 2001, MIT announced Open Course Ware (OCW). 2002, the United Nations Forum shared the Open Education Resource (OER). In 2003, China Open Resources for Education (CORE) was founded, the Open Course Ware Consortium (OCWC) was founded in 2005, and the Massive Open Online Course (MOOC) was launched in 2007. The MOOC platform officially debuted in 2012, the same year Coursera, EDX, and Udacity were launched, and Coursera co-founder Daphne Koller further promoted the concept through her TED Talk (Koller, 2012).

Investment in education, science, and technology has also been growing steadily since 2010, but 2021 sharply between 2019 and 2020, from $7 billion in 2019 to $16.1 billion in 2020 and 2021, a staggering $20.8 billion (Global, 2022). This threefold increase in three years reflects the strong demand for educational technology in the education sector, which has been severely affected by the COVID-19 pandemic. Searches for 2021 “Online learning” increased by 70% (Zmuda, 2021). A survey showed 71% of students prefer an online learning module (MIT Sloan Management, 2022). Even though the epidemic has subsided, the need for workers or professionals to pursue further education to

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remain competitive in the job market is also increasing, indicating an increasing trend towards virtual learning and online education.

The practice of online learning has always been the focus of higher education and teaching. The development of online learning dates back to the 1980s and first appeared in the United States. With the development of Internet technology, online learning entered a high-speed development era. There has been a steady and significant increase in interest in issues, suggestions for improvement, and opportunities and challenges related to online learning. All education participants recognize and experience the power and value of online learning. Online learning is the inevitable outcome of the development of information technology, but the application of information technology to support education and teaching needs to be improved. Online learning is an important part of higher education's future development, which cannot be ignored.

Located in the Southwest China region of Guizhou Province, the economy and education are developing rapidly, and there are 77 higher education schools in the province. Roblyer and Knezek (2003) point out that Internet Information Technology's role in curriculum teaching is to enhance teacher-student communication. It makes good teaching better, but good teaching is good teaching. Therefore, the integration of network information technology and teaching, according to the characteristics of information technology, research the correct methods and techniques. This research is based on the innovation of online open courses in Guizhou higher vocational schools, the new way of teaching and learning based on information technology, under the guidance of modern educational concepts such as the integration of information technology and courses, and student-centered, based on the improvement of student's ability, this paper explores and analyzes the factors of students perceived usability and learning satisfaction after using the online learning model.

In the context of vocational colleges in Guizhou, China, there exists a growing reliance on online learning platforms. However, despite their prevalence, the factors that influence student satisfaction in these platforms remain inadequately understood. Understanding these factors is crucial for enhancing the effectiveness of online education and ensuring the fulfillment of student needs and expectations.

Existing research on online learning platforms often focuses on general educational settings or overlooks specific factors pertinent to vocational colleges in Guizhou, China. Furthermore, there is a dearth of studies that comprehensively investigate the interplay among computer self-efficacy, perceived ease of use, group participation, teachers' technical readiness, student engagement, students' self-efficacy, and student satisfaction within this context. Addressing this gap is essential for tailoring educational strategies and interventions to meet the unique needs of vocational college students in Guizhou.

2. Literature Review

2.1 Student Satisfaction

The concept of student satisfaction was first proposed by American scholars, who believe universities should follow management and marketing theories to improve student satisfaction (Min et al., 2022). Alhazmi (2015) proposed that students should have their feelings during the learning process. If the learners' needs are met during the learning process, they can be called learning satisfaction, which has strong subjective emotional factors and personal experience. Locke (1969) states that learning satisfaction is the difference between what an individual expects after learning and what he wants. In psychology, satisfaction is an abstract and vague noun; its definition will vary according to different objects. Learner satisfaction and perseverance are key success factors for online universities, where all online teaching and learning activities are conducted. Saba (2020) conducted a correlation analysis to determine the relationship between students' satisfaction with the online studio and their level of learning. From this correlation study, students' satisfaction with the online learning experience was low. Many studies have investigated users' continuing e-learning intentions and found that they strongly depend on users' satisfaction with electronic systems (Lin & Wang, 2012; Zhang et al., 2012).

2.2 Computer Self-Efficacy

College students with high computer self-efficacy may find online learning platforms easy to use and realize their value and benefits. According to a meta-analysis by Abdullah and Ward (2016), computer self-efficacy was the largest predictor of students' perceived usability of online learning systems or platforms and an important predictor of students' perceived usefulness. Chen et al. (2019), Islam et al. (2018), and Islam and Sheikh (2020) suggest that learner satisfaction may also be influenced by computer self-efficacy and mediated by perceived ease of use and utility. Islam (2016) found that culture does interact with computers' sense of self-efficacy, ease of use, usefulness, and intent to use. It has influenced the adoption and satisfaction of lecturers in Malaysia and China with the use of ICT in higher education. The results of Saadé and Kira (2009) using a learning management system suggest that computer self-efficacy plays an important role in mediating the effects of anxiety on perceived ease of use. Observe this role. Compeau and Higgins (1995) provided an early definition of self-

efficacy in a blended learning environment, explaining it as the perceived usefulness of individuals when using computers to perform tasks. Thus, a hypothesis is indicated:
H1: Computer self-efficacy has a significant effect on perceived ease of use.

2.3 Perceived Ease of Use

TAM believes that perceived usefulness and ease are two major determinants of user attitudes and behaviors (Davis et al., 1989). Young et al. (2011) perceived usefulness and ease of use are important predictors of learner satisfaction and mediators of predictive factors and persistence. Chen (2022) the effect of perceived usability on intention to continue moderates perceived usefulness and student satisfaction. Others analyzed the PEU and SAT and found a positive correlation. Jabali (2022) shows that the PEU significantly impacts the SAT in the context of e-learning. Online learner satisfaction mediates between perceived ease of use and willingness to use consistently (Thiruchelvi et al., 2019). Zhai et al. (2014) empirically analyzed learners' satisfaction in English and language reversal classes. In addition, many acceptance studies on English learning based on mobile devices and software such as mobile phones have also been conducted. Azli et al. (2018) examine the impact of MALL (mobile-assisted learning) on learners of English. Hence, this study put forward a hypothesis:
H2: Perceived ease of use has a significant effect on student satisfaction.

2.4 Group Participation

Group participation learning comes from developing the connotation of cooperative learning, the subordinate concept of cooperative learning, and the most common learning style. Scholars all over the world have different understandings and definitions of the concept of group participation in learning. Slavin (1980) believes that group participation in learning is a teaching strategy teachers use to guide students into groups for learning activities, and teachers reward students with the results of the whole group. Some researchers think group participation learning is a teaching method to improve the learning effect, realized by students' interaction and mutual learning during group participation learning. Numerous studies confirm the role of sociability and the importance of interaction in the learning process (Eom & Estelami, 2012). Group and peer learning is a common practice in current learning environments and has been shown to enhance perceptual learning (Alavi, 1994). The focus of Ibrahiem and Sameh (2020) in the study is not whether a new learning approach can enhance group participation compared with traditional approaches but rather whether a new approach that can enhance group participation leads to more satisfaction among learners. Group interaction is an important predictor of student satisfaction (Sterling, 2015). Consequently, a following hypothesis is set:
H3: Group participation has a significant effect on student satisfaction.

2.5 Teachers' Technical Readiness

Regarding the technology acceptance (TAM) model, technical readiness is defined as perceived usefulness and ease of use (Venkatesh & Davis, 1996). Teacher technical readiness (TTR) refers to the individual differences in the acceptance and use of technology. That is, the individual's tendency to accept technology is greater than the ability to accept new technology. TTR is divided into positive emotions towards technology, such as optimism, innovation, etc., and negative emotions, such as discomfort, insecurity, etc., which negatively affect technology acceptance and may be psychological factors that influence technology utilization (Parasuraman, 2000). Collis (1995) states that lecturers are key to the success of online courses, and teacher preparation is important in delivering virtual courses. For the overall effectiveness of the online course, both teachers and students should be well prepared and prepared for the challenge of real-time interaction. In the online learning model, three basic characteristics of the teacher, namely, attitude to technology, teaching style, and control over technology, are critical and influence learning outcomes (Webster & Hackley, 1997). Research by Dassanayaka et al. (2022) indicates that perceived usefulness and teacher readiness are important determinants of teacher satisfaction with online instruction during COVID-19. Therefore, this study can conclude that:
H4: Teachers' technical readiness has a significant effect on student satisfaction.

2.6 Student Engagement

For a long time, "Participation" has been regarded as more than just academic participation time. From the earliest reviews incorporating terminology inputs (Mosher & McGowan, 1985) to the publication of groundbreaking theories on the foundations of drop-outs and school completion (Finn, 1989) to the recent conceptualization of inputs as multidimensional, students were involved in emotion, behavior (participation, academic study time), and cognition (Fredricks et al., 2004). Student satisfaction is considered the result of learning engagement and an effective tool for monitoring and improving the quality of education. On the one hand, based on a large body of evidence, student satisfaction results from learning engagement. Student participation is an important predictor of student satisfaction and directly predicts student satisfaction (Freire, 2005).

Rashmi (2021) student participation is an important predictor of student satisfaction. Student engagement improves student satisfaction and motivation, reduces isolation, and improves student performance in online courses (Martin & Bolliger, 2018). The study by Gray and DiLoreto (2016) also confirmed the significant impact of student engagement on student online learning and satisfaction and also found that student engagement moderated the relationship between the presence of curriculum teachers and student satisfaction. Based on previous studies, a hypothesis is suggested:
H5: Student engagement has a significant effect on student satisfaction.

2.7 Student's Self-Efficacy

Roca et al. (2006) define self-efficacy as the degree to which an individual is confident that he or she can accomplish a particular task or goal. Eom and Estelami (2012) defined self-efficacy as the individual's belief that he or she can perform a task, thereby generating a perceived level of expectation commensurate with the skills he or she possesses. Researchers use self-efficacy as a precursor to computer literacy, which may affect satisfaction (Shih, 2006). Tahereh et al. (2021) state that there is a direct relationship between personal self-efficacy and satisfaction with online education. Because various forms of self-efficacy seem to influence student satisfaction (Bates & Khasawneh, 2007; Gunawardena et al., 2010; Liao & Lu, 2008; Liao et al., 2013). The research on satisfaction shows a positive correlation between self-efficacy and satisfaction in e-learning (Womble, 2007). Self-efficacy in completing a course predicts online satisfaction (Shen et al., 2013). People who feel supported may not perceive their situation as stressful as those who do not feel fully supported.

Furthermore, higher levels of perceived social support can enhance self-efficacy by verbally persuading others, mitigating some of the negative effects of low self-efficacy (Jerusalem & Mittag, 1995). Finally, each of these variables may directly impact life satisfaction. Thus, higher levels of self-efficacy can increase satisfaction (Coffman & Gilligan, 2002). Subsequently, the researcher provides a hypothesis:
H6: Students' self-efficacy has a significant effect on student satisfaction.

3. Research Methods and Materials

3.1 Research Framework

This study explores the influencing factors of perceived usability and student satisfaction of online learning platforms in vocational colleges in Guizhou province. The researchers used the technology satisfaction model designed by Islam (2016) or the technology acceptance model (TAM) designed by Davis et al. (1989). Social learning theory and research theory combine previous relevant literature to construct a conceptual framework for students' perceived usability and satisfaction with online learning in higher vocational schools of architectural engineering. This study takes the first-year students, sophomores, and juniors of vocational colleges in Guizhou province as the research objects. It explores the factors that affect the students' perceived usability and satisfaction in using the online learning platform. Moreover, they include computer self-efficacy (CSE), perceived ease of use (PEU), student satisfaction (SS), group participation (GP), teachers' technical readiness (TTR), student engagement (SE), and students' self-efficacy (SSE).

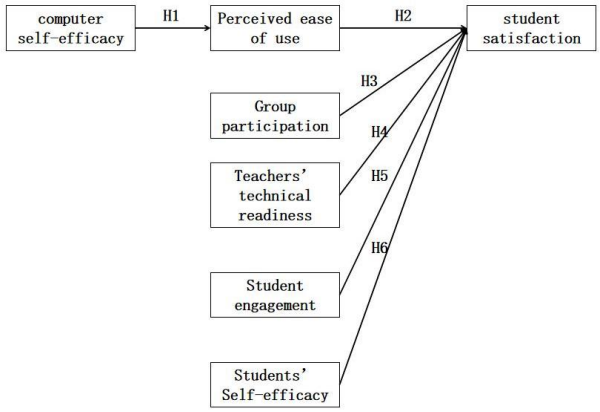

Figure 1: Conceptual Framework

H1: Computer self-efficacy has a significant effect on perceived ease of use.
H2: Perceived ease of use has a significant effect on student satisfaction.
H3: Group participation has a significant effect on student satisfaction.
H4: Teachers' technical readiness has a significant effect on student satisfaction.
H5: Student engagement has a significant effect on student satisfaction.
H6: Students' self-efficacy has a significant effect on student satisfaction.

3.2 Research Methodology

Using the quantitative Nonprobability sampling method, the researchers conducted an online questionnaire to distribute the questionnaire to the target group of students in higher vocational colleges in Guizhou Province, China. They have been studying in three higher vocational colleges in Guizhou province, and so far, they have rich experience using

the learning platform. The purpose of this study is to find out the key factors affecting student satisfaction. Five proposed variables, ranging from strongly inconsistent (1) to strongly consistent (5), were analyzed for six hypotheses. Questions about demographics, including gender, age, and race, were included in the survey. The researchers conducted preliminary testing on 50 respondents, and expert scores confirmed that the item goal consistency index (IOC) was greater than 0.6 to ensure the accuracy and reliability of the survey data. Overall, the study used a rigorous methodology to collect data on factors that significantly affect student satisfaction under the learning model of an online learning platform. The findings can provide valuable insights into improving student satisfaction and effective online learning in similar environments.

3.3 Population and Sample Size

The research object of this paper is the construction engineering students with a rich online learning experience in three vocational colleges in Guizhou Province, China. The researchers used a structural equation sampling computer to calculate the expected effect size of 0.2, the expected statistical power level of 0.8, the number of potential variables of 7, and the number of observed variables of 27, the probability scale is 0.05, the minimum sample size of the model structure is 109, and the recommended minimum sample size is 425. In conclusion, the 500-sample size suits this study and the structural equation modeling (SEM) statistical technique. This study selected first-third year students.

3.4 Sampling Technique

In this study, judgmental sampling method is to select first-year students, sophomores, and juniors from three representative vocational colleges in Guizhou Province, China. For quota sampling, the researchers assigned the number of questionnaires to be collected from each university. This allocation is based on the proportion of the population of the three vocational colleges and the number of representatives of each school: GuiZhou Polytechnic of Construction for 238 students, Guizhou Communication Vocational College for 189 students, and GuiZhou Vocational Technology College of Electronics & information for 73 students, 500 persons (Table 1). Then, the researchers used a convenience sampling method, online and offline distribution of questionnaires.

The 2023 period was about one month, from June to July. The data screening process ensures that the right target group is the construction engineering students, from first-year students to juniors in three representative vocational colleges in Guizhou Province. At the same time, they have more than one year of experience using the online learning platform. Online versions spread through social networks, including WeChat, questionnaire stars, e-mail, etc. The paper survey was distributed directly to students by teachers.

Table 1: Sample Units and Sample Size

University Name	Population Size	Proportional Sample Size
GuiZhou Polytechnic of Construction	2765	238
Guizhou Communication Vocational College	2200	189
GuiZhou Vocational Technology College of Electronics & Information	850	73
Total	**5815**	**500**

Source: Constructed by author

4. Results and Discussion

4.1 Demographic Information

In this study, 500 questionnaires were distributed to all target students by quota sampling. Screening questions help to weed out unqualified participants. The final sample size was 494 students from Guizhou Province, China, vocational colleges. In Table 2, most participants were men (53.8%) and women (46.2%). The target population of this study is 189 freshmen (38.3%), 136 sophomores (27.5%), and 169 juniors (34.2%). According to the survey, the proportion of students who used to live in cities and Towns is 293, accounting for 59.3%, and 201 students live in suburbs, accounting for 40.7%. The percentage of students who prefer to use computers and 305 students who prefer to use mobile phones is 189. The proportion of students who spend time on the Internet is 177 students in many hours, 237 students in more hours, and 80 students in less time, as shown in Table 2.

Table 2: Demographic Profile

Demographic and General Data (N=494)		Frequency	Percentage
Gender	Male	266	53.8%
	Female	228	46.2%
Grade	First grade	189	38.3%
	Second grade	136	27.5%
	Third grade	169	34.2%
Family location	Countryside	201	40.7%
	City	293	59.3%
The way the Internet	Computers	189	38.3%
	Smartphones	305	61.7%
The time it takes to study online	A lot	177	35.8%
	More	237	48%
	Rarely	80	16.2%

Source: Constructed by author

4.2 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was used in this study. All items in each variable are significant and represent factor loads to test for discriminant validity. Significance and acceptable values for factor loads for each item indicate goodness of fit (Hair et al., 2006). The factor load value is greater than 0.30, and the P value is less than 0.05. The cut-off point in Table 3 has a reliability greater than 0.7 and a mean variance of extraction greater than 0.5 (Fornell & Larcker, 1981). All the indicators are up to standard.

Table 3: Confirmatory Factor Analysis Result, Composite Reliability (CR) and Average Variance Extracted (AVE)

Variables	Source of Questionnaire (Measurement Indicator)	No. of Item	Cronbach's Alpha	Factors Loading	CR	AVE
Computer Self-efficacy (CSE)	Chen et al. (2019)	4	0.817	0.674-0.767	0.818	0.531
Perceived Ease of Use (PEU)	Joo et al. (2011)	4	0.854	0.569-0.981	0.856	0.611
Student Satisfaction (SS)	Alhazmi (2015)	4	0.795	0.689-0.719	0.795	0.492
Group Participation (GP)	Slavin (1980)	3	0.830	0.761-0.801	0.831	0.621
Teachers' Technical Readiness (TTR)	Venkatesh and Davis (1996)	3	0.860	0.811-0.838	0.860	0.673
Student's Engagement (SE)	Finn (1989)	5	0.891	0.598-0.964	0.873	0.589
Student's Self-efficacy (SSE)	Roca et al. (2006)	4	0.791	0.655-0.746	0.792	0.488

The square root of the extracted mean-variance determines that all correlation coefficients are greater than the corresponding correlation values for the variable in Table 4. In addition, the CFA test used GFI, AGFI, NFI, CFI, TLI, and RMSEA as model-fitting indexes.

Table 4: Goodness of Fit for Measurement Model

Fit Index	Acceptable Criteria	Statistical Values
CMIN/DF	< 5.00 (Al-Mamary & Shamsuddin, 2015; Awang, 2012)	3.091
GFI	≥ 0.85 (Sica & Ghisi, 2007)	0.874
AGFI	≥ 0.80 (Sica & Ghisi, 2007)	0.843
NFI	≥ 0.80 (Wu & Wang, 2006)	0.868
CFI	≥ 0.80 (Bentler, 1990)	0.906
TLI	≥ 0.80 (Sharma et al., 2005)	0.891
RMSEA	< 0.08 (Pedroso et al., 2016)	0.065
Model Summary		**In harmony with empirical data**

Remark: CMIN/DF = The ratio of the chi-square value to degree of freedom, GFI = Goodness-of-fit index, AGFI = Adjusted goodness-of-fit index, NFI = Normed fit index, CFI = Comparative fit index, TLI = Tucker-Lewis index, and RMSEA = Root mean square error of approximation

In this study, the values shown in Table 5 are all larger than the acceptable values, verifying the convergence and discriminant validity. Therefore, the convergence validity and discriminant validity of the algorithm are guaranteed. In addition, the results of these models can also be used to verify the validity of subsequent structural model estimates.

Table 5: Discriminant Validity

	CSE	PEU	SS	GP	TTR	SE	SSE
CSE	**0.728**						
PEU	0.284	**0.782**					
SS	0.597	0.468	**0.702**				
GP	0.247	0.063	0.205	**0.788**			
TTR	0.353	0.288	0.491	0.200	**0.820**		
SE	0.234	0.253	0.424	0.163	0.308	**0.768**	
SSE	0.360	0.199	0.528	0.250	0.315	0.242	**0.699**

Note: The diagonally listed value is the AVE square roots of the variables
Source: Created by the author.

4.3 Structural Equation Model (SEM)

According to Hair et al. (2010), structural equation modeling (SEM) validates the random relationship between variables in the proposed model and incorporates measurement errors of the structural coefficients. The Index of goodness of fit evaluates the model fitting of the structural model. The selected fit Index is the same as CFA. It includes chi-square statistic (CMINDF), goodness of fit Index (GFI), adjusted goodness of fit Index (AGFI), Norm Goodness of fit Index (NFI), comparative goodness of fit Index (CFI), Tuck-lewis index (TLI) and root mean square error (RMSEA). The indices will assess six potential variables: computer self-efficacy, perceived ease of use, group participation, teachers' technical readiness, student engagement, students' Self-efficacy, and student satisfaction.

Structural equation model (SEM) fit indices are measured as shown in Table 6. The statistical results were CMIN/DF = 2.731, GFI = 0.872, AGFI = 0.847, NFI = 0.879, CFI = 0.919, TLI = 0.910, RMSEA = 0.059.

Table 6: Goodness of Fit for Structural Model

Index	Acceptable	Statistical Values
CMIN/DF	< 5.00 (Al-Mamary & Shamsuddin, 2015; Awang, 2012)	2.731
GFI	≥ 0.85 (Sica & Ghisi, 2007)	0.872
AGFI	≥ 0.80 (Sica & Ghisi, 2007)	0.847
NFI	≥ 0.80 (Wu & Wang, 2006)	0.879
CFI	≥ 0.80 (Bentler, 1990)	0.919

Index	Acceptable	Statistical Values
TLI	≥ 0.80 (Sharma et al., 2005)	0.910
RMSEA	< 0.08 (Pedroso et al., 2016)	0.059
Model Summary		**In harmony with Empirical data**

Remark: CMIN/DF = The ratio of the chi-square value to degree of freedom, GFI = Goodness-of-fit index, AGFI = Adjusted goodness-of-fit index, NFI = Normed fit index, CFI = Comparative fit index, TLI = Tucker-Lewis index, and RMSEA = Root mean square error of approximation

4.4 Research Hypothesis Testing Result

In hypothesis, the magnitude of the correlation between the proposed independent and dependent variables is measured by a a standardized path coefficient. As shown in Table 7, five of the six proposed assumptions are supported. Under the model of an online learning platform, students' satisfaction is strongly influenced by perceived usability and then students' self-efficacy. Students' satisfaction with the online learning platform is significantly driven by students' participation and teachers' technical preparation.

The study model determined the importance of each construct from the normalized path coefficient (β) and T values shown in Table 7. As the significance hypothesis was supported at P = 0.05, perceived ease of use had the greatest effect on student satisfaction at β = 0.330 and t-value = 6.774. However, this study found no significant relationship between group participation and student satisfaction, showing β = 0.049 and t = 1.002.

Table 7: Hypothesis Results of the Structural Equation Modeling

Hypothesis	(β)	t-Value	Result
H1: CSE → PEU	0.285	5.691*	Supported
H2: PEU → SS	0.330	6.774*	Supported
H3: GP → PU	0.049	1.002	Not Supported
H4: TTR→ SS	0.286	5.583*	Supported
H5: SE → SS	0.231	4.911*	Supported
H6: SSE → SS	0.381	6.620*	Supported

Note: * p<0.05
Source: Created by the author

H1 shows that the computer self-efficacy of students using online learning platforms positively affects perceived ease of use, with standard coefficient value = 0.285 and T value = 5.691, respectively. Computer self-efficacy plays an important role in mediating the effects of anxiety on perceived ease of use, and this result is also supported by the literature (Abdullah & Ward, 2016; Islam et al., 2018). **H2** shows that when students use online learning platforms, standard coefficient value = 0.330, T value = 6.774, perceived ease of use has a strong positive impact on student satisfaction; this result is consistent with previous literature (Alfadda & Mahdi, 2021; Davis, 1989; Hsu & Lin, 2008; Jabali, 2022). The results of **H3** show that the standard coefficient value = 0.049, T value = 1.002. Group participation has no strong positive effect on the students' satisfaction when they use the online learning platform, so this hypothesis cannot be supported. Combined with the actual situation of this study, when students use online learning platforms, group collaboration has little effect on students' learning effectiveness and satisfaction. H4 demonstrated a strong positive effect of teacher technical preparation on student satisfaction, with a standard coefficient value = 0.286 and T value = 5.583, a result supported by numerous literature (Bolliger, 2004; Collis, 1995; Dassanayaka et al., 2022; Rashmi, 2021). **H5** verified that student participation had a strong positive effect on student satisfaction, with standard coefficient value = 0.231, T value = 4.911, a result supported by numerous literature (Lewis et al., 2011; Martin & Bolliger, 2018; Rashmi, 2021). **H6** demonstrated a strong positive effect of student self-efficacy on student satisfaction, with standard coefficient value = 0.381, T value = 6.620, which is consistent with previous studies (Coffman & Gilligan, 2002; Shen et al., 2013; Tahereh et al., 2021; Thiruchelvi et al., 2019;)

5. Conclusion and Recommendation

5.1 Conclusion and Discussion

This study investigated the perceived usability and the factors influencing the satisfaction of first-, second-, and third-year construction engineering students using the online learning platform in Guizhou Province, China. These assumptions are presented as conceptual frameworks, and this study examines how students' computer self-efficacy, perceived ease of use, group participation, teachers' technical readiness, and student engagement significantly impact student satisfaction. The questionnaire was developed and distributed to a target sample of students, who are freshmen to juniors majoring in architectural engineering in three vocational colleges in Guizhou Province. Confirmatory factor analysis (CFA) was used to measure and test the validity and reliability of the conceptual model. Therefore, this paper uses structural equation modeling (SEM) to analyze the factors that affect students' perceived usability and satisfaction using online learning platforms.

The results are as follows. In the online learning platform, perceived usability strongly influences students' satisfaction. Perceived ease of use (Islam, 2016) is the perception of the difficulty of using an online learning platform by college students. The stronger the perceived ease of use is, the higher the satisfaction of using an online learning platform. According to the results of the study, we can conclude that perceived ease of use is an important predictor of learner

satisfaction, which is an important mediator between the predictive factors and persistence (Chen, 2022; Jabali, 2022; Thiruchelvi et al., 2019).

Secondly, students' self-efficacy has a strong influence on students' satisfaction of using online learning platforms. Joseph et al. (2002), argued that self-efficacy is related to college students' satisfaction and that people with self-efficacy tend to be more satisfied with college life. Research has shown that positive psychological adaptation to stressful life transitions includes several components, including individual psychological and social support. People with high self-efficacy may view a stressful environment as a challenge rather than a threat because they believe in their ability to manage the demands of the environment. Higher levels of perceived social support can enhance self-efficacy by verbally persuading others, mitigating some of the negative effects of low self-efficacy (Jerusalem & Mittag, 1995). Thus, higher levels of self-efficacy can increase satisfaction (Coffman & Gilligan, 2002).

Third, students' computer self-efficacy has a strong positive effect on perceived ease of use. College students with high computer self-efficacy may find online learning platforms easy to use and realize their value and benefits. This result is supported by previous literature. According to Abdullah and Ward (2016), computer self-efficacy is the largest predictor of students' perceived ease of use of online learning systems or platforms, and it is also an important predictor of student satisfaction.

Fourthly, teachers' technical preparation has a strong positive effect on students' satisfaction with using online platforms. The level of readiness of teachers to teach online implies the degree to which teachers are mentally and technically (easy to use) able to take on challenges (Dassanayaka et al., 2022). The results show that the full technical preparation of teachers is conducive to the successful grasp of curriculum teaching; general education has a strong impact on the effectiveness of curriculum teaching and learning of students. Research by Dassanayaka et al. (2022) indicates that perceived usefulness and teacher readiness are important determinants of teacher attitudes toward online instruction during COVID-19, with strong positive effects on student satisfaction.

Fifth, student engagement affects student satisfaction, which is the result of learning input and an effective tool for monitoring and improving the quality of education. Lakshmi et al. (2020) states that student engagement is an important predictor of student satisfaction. Student engagement is divided into three components: behavior, emotion, and cognition (Fredricks et al., 2004). This result is supported by numerous previous literature (Ghada et al., 2021; Rashmi, 2021).

Finally, in this study, group participation has no significant effect on students' satisfaction with online platforms. In previous studies, group participation has a positive effect on student satisfaction in blended instruction and has been supported by several scholars (Mulligan et al., 2019; Salas et al., 1992; Tannenbaum et al., 1992; Wageman & Baker, 1997). The results of this study show that group participation has no strong positive effect on students' satisfaction when students use online learning platforms, and group collaboration has little effect on students' learning effectiveness and satisfaction.

5.2 Recommendation

Researchers have found key determinants of perceived ease of use and satisfaction with online learning platforms in higher vocational colleges in Guizhou Province, China: computer self-efficacy, teachers' technical readiness, student engagement, and students' self-efficacy. Therefore, according to the study results on China's higher vocational colleges' online learning and teaching model, make the following recommendations. First, to build a stable and unified teaching platform and improve the sharing of high-quality resources. A unified and stable online teaching platform is a powerful guarantee for the efficient operation of online supplementary teaching in schools in the future. An online education platform with stable function and convenient operation is strong support for teachers to show their skills as preachers. Speed up the construction of the online education platform, the school, after the resumption of classes, does not draw a line with the live platform but can also make full use of it, and play its maximum value. Second, teachers and students improve the adaptability of online teaching to achieve effective interaction between teachers and students. Because of the problem of the interaction between teachers and students in class and the low participation of students in class, the adaptability of teachers and students in online teaching can be improved, including the adaptability of learning concepts, the adaptability of the learning environment, and the adaptability of learning style. Third, college students should strengthen self-management and cultivate self-learning abilities. Aiming at the problem of poor students' autonomy, we can improve students' learning autonomy in online teaching from both teachers and students. In the teaching process, teachers can guide and stimulate students to participate actively in interaction and properly use teaching strategies to build an interactive platform for students and a shared learning knowledge community. Moreover, the interaction should be monitored to improve students' learning experience and learning quality.

5.3 Limitation and Further Study

The limitation of this study is that the population and sample are composed of first-year students, sophomores, and

juniors from three higher vocational colleges in Guizhou province. The analysis results may vary depending on the organization's size, industry, culture, or country. In addition, future studies could use experimental methods to control for other variables that might confound causality, such as defining a specific quality factor and observing the effect of that independent variable on the intention to act on the dependent variable. Finally, to better understand university student use, the network study satisfaction may increase the qualitative research, causing the research to be richer and more thorough.

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