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An Analysis of Factors Influencing College Students' Satisfaction With E-learning: A Case Study of Guangdong City Technician College in Guangdong, China

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Abstract

Purpose: This study investigates the influence of six independent variables (System Quality Perceived Usefulness, Perceived Ease of Use, and Confirmation) on the dependent variable (Satisfaction) with e-learning. Additionally, it aims to identify significant differences between pre-and post-strategic planning interventions. **Research design, data, and methodology:** The research utilized the Index of Item-Objective Congruence (IOC) for validity and Cronbach's Alpha in a pilot test (n=30) for reliability. Ninety valid responses from Guangdong City Technician College students were analyzed using multiple linear regression and ANOVA tests to verify the significant relationships between variables. Following this, a strategic planning intervention was implemented, and the same 90 students were surveyed post-intervention. Paired samples t-tests were conducted to compare pre-and post-intervention results. **Results:** The multiple linear regression analysis revealed that System Quality, Service Quality, Information Quality, Perceived Usefulness, Perceived Ease of Use, and Confirmation significantly impacted students' satisfaction with e-learning. The paired samples t-test demonstrated significant differences in all variables between the pre-and post-strategic planning stages, indicating the effectiveness of the interventions. **Conclusions:** This research highlights the importance of strategic planning in enhancing e-learning satisfaction by improving system and service quality, information relevance, usability, and perceived usefulness. The findings underscore the need for continuous monitoring and iterative improvements to maintain high levels of student satisfaction in e-learning environments.

Keywords : E-learning, Satisfaction, Strategic Planning, Perceived Usefulness, Confirmation

JEL Classification Code: I23, J28, L2

1. Introduction

As a transformative and versatile teaching mode, e-learning has experienced a significant surge in adoption across universities, particularly accelerated by the outbreak of the novel coronavirus pneumonia epidemic (Xiong et al., 2021). This global health crisis has not only expedited the widespread application of online teaching but also sparked a wave of innovation in educational delivery. E-learning, as a technological enabler, offers a dynamic platform that transcends traditional classroom boundaries, empowering students to interact with educational materials in a flexible and accessible manner (Elumalai et al., 2021).

The roots of e-learning can be traced back to the early 1990s when online courses first emerged (Siemens, 2005). Since then, the landscape has evolved from basic online courses to sophisticated platforms that integrate multimedia elements and foster interactive learning experiences. Recent advancements, such as the integration of mobile technology, virtual reality, and artificial intelligence, have further propelled the developmental trajectory of e-learning (Mulabu, 2023).

However, the widespread adoption of e-learning brings forth both opportunities and challenges. While it provides a flexible and diverse learning mode for college students, it also poses unique challenges that require careful examination. As universities increasingly integrate e-learning into their educational strategies, it becomes more crucial than ever to understand the factors influencing

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college students' satisfaction with this mode of learning.

This research, titled "An Analysis of Factors Influencing College Students' Satisfaction with E-Learning: A Case Study of Guangdong City Technician College in Guangdong, China," embarks on an in-depth exploration of the elements shaping students' satisfaction with e-learning. The study's findings are not only significant but also groundbreaking, as they unravel the intricate dynamics contributing to the effectiveness and acceptance of this educational modality. By examining specific objectives, methodology, and findings, the research sheds light on the factors significantly impacting college students' satisfaction with e-learning at Guangdong City Technician College. This investigation not only identifies challenges but also proposes strategic interventions and recommendations to enhance the overall e-learning experience for students in the evolving landscape of higher education.

2. Literature Review

2.1 System Quality

System quality is crucial in information technology and systems, reflecting a system's overall excellence, reliability, and effectiveness in meeting specific requirements (Delone & McLean, 1992; Seddon, 1997). It encompasses accuracy, convenience, access speed, efficiency, flexibility, security, and reliability (DeLone & McLean, 2003). In e-learning, system quality is vital for both teaching and learning experiences (Almarashdeh, 2016; Freeze et al., 2019; Mohammadi, 2015), extending beyond hardware and software to the perceived quality of user interactions (Chen & Tseng, 2012; Cho et al., 2009; Pituch & Lee, 2006). Key factors include functionality, data quality, network stability, usability, and timely problem resolution (Calisir et al., 2014). Attributes like accuracy, ease of use, flexibility, and responsiveness are essential (Doll & Torkzadeh, 1988; Teo & Wong, 2000). Learners' perceptions of system quality significantly influence their satisfaction and perceived benefits, making it a critical determinant of e-learning success (Cheng, 2014; DeLone & McLean, 2003; Roca et al., 2006).

H1: System quality has a significant impact on satisfaction with e-learning.

2.2 Service Quality

Service quality is crucial for customer satisfaction and organizational success, encompassing reliability, responsiveness, assurance, empathy, and tangibles (Gronroos, 1984; Parasuraman et al., 1988; Zeithaml et al., 1990). E-services also include website functionality, security, and efficiency (Parasuraman et al., 2005). For e-learning systems, service quality involves meeting users' needs for timely, reliable, professional, and personalized services (Yang & Lin, 2015). It includes responsiveness, reliability, commitment fulfillment, and understanding of user needs (Chang, 2013; Jung et al., 2015). In higher education, service quality is assessed by the gap between students' expectations and actual experiences (Mohammadi, 2015; Wang & Wang, 2009), impacting the support for teachers and the effectiveness of e-learning platforms. The evolution of technology has emphasized the ongoing evaluation of electronic service quality, with dissatisfaction arising when expectations are unmet (Al-dweeri et al., 2019; Anderson & Swaminathan, 2011; Rita et al., 2019).

H2: Service quality has a significant impact on satisfaction with e-learning.

2.3 Information Quality

Information quality is crucial for user satisfaction in end-user computing, web user attitudes, and e-commerce success, as it encompasses accurate, reliable, and relevant information (DeLone & McLean, 2004; Doll & Torkzadeh, 1988; Teo & Wong, 2000). It is defined by how users perceive information as relevant, timely, accurate, and complete, impacting content presentation on websites and internet applications (Chang, 2013; Yakubu & Dasuki, 2018). Key characteristics include understandability, validity, and completeness, essential for students to enhance their understanding of curriculum concepts (Wixom & Todd, 2005; Zha et al., 2017). Information quality also influences teachers' practices by meeting learners' information needs and improving their teaching practices (Gustavsson & Wanstrom, 2009; Wang & Wang, 2009). In summary, information quality significantly impacts learners' satisfaction and the practicality and use of e-learning systems (DeLone & McLean, 2003).

H3: Information quality has a significant impact on satisfaction with e-learning.

2.4 Perceived Usefulness

Perceived usefulness, initially defined by Davis (1989) as the belief that using a system enhances job performance, has been expanded to include users' belief in the positive impact on future performance (Alami & Idrissi, 2022). In education, it refers to students' conviction that technology aids in achieving learning goals (Limayem & Cheung, 2008) and represents the benefits of using wireless Internet for learning (Islam, 2014). During the COVID-19 pandemic, the importance of perceived usefulness in e-learning tools became particularly evident, highlighting its role in adapting to evolving educational needs (Nedeljkovic & Rejman

Petrovic, 2022). In summary, perceived usefulness reflects confidence in a technology's ability to enhance performance and achieve personal or learning goals.
H4: Perceived usefulness has a significant impact on satisfaction with e-learning.

2.5 Perceived Ease of Use

Perceived ease of use (PEOU), initially defined by Davis (1989) as the belief that using a system is effortless, encompasses cognitive and physical simplicity in system interaction. Venkatesh et al. (2003) and Legris et al. (2003) emphasized intuitive design and minimal effort required. In educational settings, PEOU reflects how easily students can use technology to achieve learning goals (Al-Emran et al., 2020). It is crucial in e-learning, influencing user attitudes and adoption by assessing the ease of learning, accessing, and performing tasks with specific e-learning software (Almarashdeh, 2016; Islam et al., 2015). This understanding highlights the importance of PEOU in shaping user behaviors and technology acceptance.
H5: Perceived ease of use has a significant impact on satisfaction with e-learning.

2.6 Confirmation

Bhattacherjee (2001) and Bhattacherjee and Lin (2015) emphasize the role of confirmation in users' perceptions and continued usage of technology, highlighting its impact on satisfaction and intention to continue using systems like information systems and mobile banking apps. Oliver (1980) Expectation Confirmation Theory model underscores that users' satisfaction is shaped by comparing their expectations with actual experiences. Research by Chen and Chan (2014) and Hossain et al. (2019) further demonstrates confirmation's influence on user engagement and satisfaction in social networking and e-learning contexts. Confirmation is the user's evaluation of technology performance relative to their initial expectations, which is critical in determining ongoing usage intentions (Alami & Idrissi, 2022). Influenced by factors such as perceived usefulness and service satisfaction, confirmation significantly shapes users' satisfaction and continued use of e-learning systems (Cheng, 2014; Chiu et al., 2005; Farrell et al., 2016; Roca et al., 2006). Thus, confirmation is a key psychological and cognitive factor affecting user perceptions and technology adoption.
H5: Confirmation has a significant impact on satisfaction with e-learning.

2.6 Satisfaction

Satisfaction, a multifaceted concept, encompasses emotional, cognitive, and evaluative aspects. Oliver (1980) defines it as overall contentment derived from an experience, service, or product, while Westbrook (1987) emphasizes the positive emotional response. Zeithaml et al. (1996) view it as a rational performance assessment against predefined criteria, and Kotler et al. (2009) describe it as fulfilling needs and desires. Satisfaction also involves an ongoing process of comparison and adaptation (Tse et al., 2014). In e-learning, satisfaction is the extent to which students feel their expectations are met in virtual learning environments, reflecting their overall online experience, pleasure, and evaluation of system performance (Alami & Idrissi, 2022; Martin-Rodriguez & Fernández-Navarro, 2015; Teo, 2014). Influenced by perceived usefulness and expectation confirmation, satisfaction is crucial for determining student loyalty and platform recommendation (Ali et al., 2016).

3. Research Methods and Materials

3.1 Research Framework

This study constructs a conceptual framework based on three core research theories from extensive literature. It integrates (1) DeLone and McLean's Information System Success Model (D & M ISS), (2) the Technology Acceptance Model (TAM), and (3) the Expectancy-Confirmation Model (ECM). These theoretical frameworks, supported by previous research, underpin the conceptual framework depicted in Figure 1.

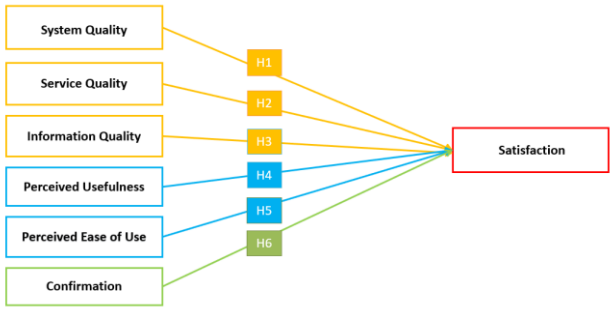

Figure 1: Conceptual Framework

H1**:** System quality has a significant impact on satisfaction with e-learning.
H2: Service quality has a significant impact on satisfaction with e-learning.
H3: Information quality has a significant impact on satisfaction with e-learning.

H4: Perceived usefulness has a significant impact on satisfaction with e-learning.
H5: Perceived ease of use has a significant impact on satisfaction with e-learning.
H6: Confirmation has a significant impact on satisfaction with e-learning.

3.2 Research Methodology

This study employs a comprehensive mixed-methods research approach to thoroughly investigate and enhance college students' satisfaction with e-learning. The research methodology involves several key stages:

In the quantitative phase, data was collected using a structured questionnaire distributed via the "Questionnaire Star" online platform. The questionnaire underwent rigorous validation through Item-Objective Congruence (IOC) and a pilot test to ensure reliability. Statistical analysis using Jamovi, specifically linear regression, was employed to empirically examine theoretical frameworks and relationships among variables related to e-learning satisfaction.

Secondly, a strategic planning intervention was implemented over eight weeks, targeting identified areas for improvement based on pre-strategy analysis outcomes. Participants actively engaged in this process, fostering collaboration and development within the e-learning environment.

Lastly, a post-strategy evaluation was conducted to assess changes in participants' satisfaction and experiences with e-learning. The effectiveness of the strategic planning intervention was evaluated using statistical tools such as the Paired t-test to compare dependent variables before and after intervention.

By integrating quantitative findings with strategic planning outcomes, this research aims to provide a comprehensive understanding of factors influencing e-learning satisfaction and the potentially transformative impact of strategic planning interventions in educational settings.

3.3 Research Population, Sample Size, and Sampling Procedures

3.3.1 Research Population

This study focuses on undergraduate students enrolled at Guangdong City Technician College during the academic year 2022, specifically those with experience in online learning. Located in Guangdong Province, southern China, the province has numerous higher education institutions, including 71 undergraduate institutions and 91 vocational colleges. Guangdong City Technician College, established in 2005 and recognized as a demonstrative vocational college, serves as the specific target population for this research, encompassing students engaged in various e-learning activities within the institution.

3.3.2 Sample size

In the second research stage, a stratified random sampling method created strata based on course types. From the total population of 330 students, 90 individuals were proportionally sampled across the three courses: 33 from English, 27 from Chinese, and 30 from computer courses. This approach ensured that each course type was adequately represented in the sample, facilitating a comprehensive analysis of factors influencing satisfaction with e-learning at Guangdong City Technician College.

3.3.3 Sampling Procedures

The study employed a purposive sampling approach to select participants from Guangdong City Technician College who had experience with Tencent Meeting courses in 2022. This method targeted students familiar with the e-learning platform, ensuring relevance to the research objectives. Three hundred thirty participants were included: 120 from English, 100 from Chinese, and 110 from computer courses. The selection process was designed to capture a diverse representation across different academic disciplines, supporting the study's focus on e-learning satisfaction.

Sampling 1: Pilot Survey and Pilot Test

Initially, 30 students were randomly sampled to participate in the pilot survey and pilot test. Their role was crucial as they were requested to complete a survey questionnaire and provide feedback, which was instrumental in refining the research instruments.

Sampling 2: Pre-strategic Planning

Subsequently, 90 students from different academic years were selected through a printed questionnaire for pre-strategic planning. Following data collection, all 90 responses were meticulously validated for accuracy and completeness, ensuring the thoroughness of the process.

Sampling 3: Strategic Planning

From the validated pool of 90 participants, volunteers were chosen to engage in the strategic planning phase, ensuring active participation and commitment to the intervention.

These sampling procedures ensured the study's rigor and relevance in exploring factors influencing e-learning satisfaction among undergraduate students at Guangdong City Technician College.

3.4 Research Instruments

3.4.1 Design of Questionnaire

In this research, the questionnaires were structured into two sections. The initial section incorporated demographic inquiries concerning gender and the enrolled course. The second section utilized a five-point Likert scale to analyze factors influencing college students' satisfaction with e-learning. As the questionnaires were disseminated in China, meticulous efforts were made to translate the questions into Chinese, ensuring that respondents could grasp and respond to them effectively. The second segment of the questionnaire delves into the impact of satisfaction in E-learning, gauged by the extent of agreement or disagreement on rating scales. To assess items in the questionnaires, this study employed a 5-point Likert scale (Likert, 1932). It ranges from categories like Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), to Strongly Agree (5) (Dawes, 2008; Joshi et al., 2015).

3.4.2 Components of Questionnaire

Table 1: Components of Questionnaire

Variables	No. of Items	Example	Reference
System Quality	6	E-learning systems respond quickly at t he busiest times of the day.	Chang (2013)
Service Quality	6	I can get adequate support services from the service administrator of the e-learning system to help me learn.	Chang (2013)
Information Quality	7	I can get adequate support services from the service administrator of the e-learning system to help me learn.	Chang (2013)
Perceived Usefulness	6	E-learning makes it easy to track and learn course materials.	Legramante et al. (2023)
Perceived Ease of Use	6	I considered e-learning is easy for me.	Legramante et al. (2023)
Confirmati on	6	I use e-learning system to study better than I thought.	Bhattacherjee (2001)
Satisfaction	6	I use e-learning system to study better than I thought.	Legramante et al. (2023)

3.4.3 IOC Results

The Item Objective Congruence (IOC) method was employed to ensure the validity of the content of the questionnaire items. Five experts were selected based on their educational backgrounds and professional roles in education, all from Chinese universities. Each expert assessed the items against specific criteria: assigning a score of 1 if an item effectively measured the intended attribute, -1 if it did not, and 0 if uncertain. All questionnaire items received scores greater than 0.67, leading the researcher to retain all items for the study, indicating strong alignment with the intended constructs.

3.4.4 Pilot survey and Pilot test results

The internal consistency of the constructs was assessed using Cronbach's alpha with a sample of 30 participants. The results indicated robust reliability across all constructs. Specifically, the Cronbach's alpha values for System Quality (SYQ), Service Quality (SEQ), Information Quality (IQ), Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Confirmation, and Satisfaction were 0.813, 0.884, 0.726, 0.865, 0.894, 0.897, and 0.829, respectively. The reliability coefficients surpassed the acceptable threshold of 0.7 or 0.6 (Taber, 2018), confirming the constructs' strong internal consistency and the questionnaire's reliability. The consistently high alpha coefficients across all variables affirm the reliability of the measurement instrument employed in this study.

Table 2: Pilot Test Result

Variables	Cronbach's Alpha	Strength of Association
System Quality	0.813	Very good
Service Quality	0.884	Very good
Information Quality	0.726	Good
Perceived Usefulness	0.865	Very good
Perceived Ease of Use	0.894	Very good
Confirmation	0.897	Very good
Satisfaction	0.829	Very good

4. Results and Discussion

4.1 Results

4.1.1 Demographic Profile

The study exclusively focuses on participants affiliated with the Cultural Circle Workshop, comprising students aged between 18 and 20 years. A comprehensive overview of the participants' basic information is summarized in the following table.

Table 3: Demographic Profile

Entire Research Population		Number of students	Total Percent
English Course	Male	15	16.67%
	Female	18	20%
Chinese Course	Male	11	12.22%
	Female	16	17.78%
Computer Course	Male	17	18.89%
	Female	13	14.44%

4.1.2 Results of multiple linear regression

Jamovi proposes six hypotheses at the diagnosis stage. After running the multiple linear regression, the linear regression model is well-fitted, with an R-squared value of 0.962, indicating that the model explains approximately 96.2% of the variance in the dependent variable (SAT). The adjusted R-squared is 0.959, considering the number of predictors in the model.

Table 4: The multiple linear regression of five independent variables on satisfaction

Variables	Standardized Coefficients Beta	P-value	t	R	R Square
System Quality	0.0761	0.012	-4.53	0.962	0.959
Service Quality	0.046	0.048	-3.68		
Information Quality	0.1104	0.003	-3.17		
Perceived Usefulness	0.0682	0.017	-3.83		
Perceived Ease of Use	0.06	0.025	-3.42		
Confirmation	0.0653	0.019	-3.69		
Dependent variable: Student learning Performance					

Note: p-value <0.05*, p-value <0.001**

The output presents the results of a linear regression analysis examining the relationship between the dependent variable satisfaction (SAT) and the independent variables System Quality (SYQ), Service Quality (SEQ), Information Quality (IQ), Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Confirmation (CON).

The tests for the overall model and individual predictors are highly significant ($p < 0.001$), suggesting that the model fits the data well. The Effect Size ($\eta^2 p$) values indicate the proportion of variance in the dependent variable explained by each predictor. The model has a high effect size of 0.962. Each predictor, including System Quality (SYQ), Service Quality (SEQ), Information Quality (IQ), Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Confirmation (CON), significantly contributes to the model (all p-values < 0.05).

Therefore,

H6: There is a significant mean difference in System Quality between pre-SP and post-SP.

H7: There is a significant mean difference in Service Quality between pre-SP and post-SP.

H8: There is a significant mean difference in Information Quality between pre-SP and post-SP.

H9: There is a significant mean difference in Perceived Usefulness between pre-SP and post-SP.

H10: There is a significant mean difference in Confirmation between pre-SP and post-SP.

H11: There is a significant mean difference in Satisfaction between pre-SP and post-SP.

In conclusion, the linear regression model, with its high R-squared value and significant predictors, effectively explains the variance in SAT scores. The results suggest that System Quality, Service Quality, Information Quality, Perceived Usefulness, Perceived Ease of Use, and Confirmation all play meaningful roles in influencing satisfaction scores among the study participants.

4.2 Strategic Plan Process

After the multiple linear regression test, the finalized strategic planning model was completed. Strategic planning should be a systematic process that considers multiple aspects to enhance satisfaction. Figure 2 provides an overview of the strategic planning model for System Quality, Service Quality, Information Quality, Perceived Usefulness, Perceived Ease of Use, and Confirmation.

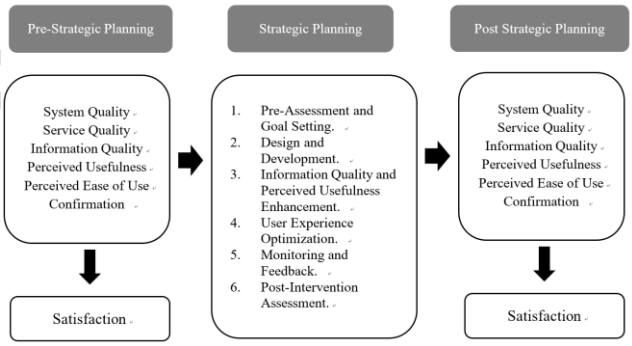

Figure 1: Strategic Planning Model

4.3 Results Comparison between Pre-IDI and Post-IDI

The researcher conducted paired-sample t-tests on all seven variables to analyze the differences between measurements before and after strategic planning. The below tables to illustrates paired-sample t-test analysis on those variables as follows:

Table 5: Paired-Sample T-Test Results

Variables	Mean	SD	p-value
System Quality			
Pre-Strategic Plan	4.49	0.501	< .001
Post-Strategic Plan	4.59	0.414	
Service Quality			
Pre-Strategic Plan	4.5	0.495	< .001
Post-Strategic Plan	4.59	0.394	
Information Quality			

Variables	Mean	SD	p-value
Pre-Strategic Plan	4.47	0.501	0.002
Post-Strategic Plan	4.55	0.407	
Perceived Usefulness			
Pre-Strategic Plan	4.49	0.495	< .001
Post-Strategic Plan	4.57	0.402	
Perceived Ease of Use			
Pre-Strategic Plan	4.52	0.503	<0.001
Post-Strategic Plan	4.6	0.401	< .001
Confirmation			
Pre-Strategic Plan	4.44	0.525	< .001
Post-Strategic Plan	4.52	0.45	
Satisfaction			
Pre-Strategic Plan	4.46	0.529	< .001
Post-Strategic Plan	4.59	0.403	

There was a significant difference in system quality between the pre-intervention (M=4.49, SD=0.501) and post-intervention (M=4.59, SD=0.414) conditions; t (89) = -4.53, p < .001. The mean difference was -0.10. The increase in mean scores, combined with a significant p-value, indicates that strategic planning effectively enhanced the system quality as perceived by the participants.

There was a significant difference in service quality between the pre-intervention (M=4.5, SD=0.495) and post-intervention (M=4.59, SD=0.394) conditions; t (89) = -3.68, p < .001. The mean difference was -0.09. The increase in mean scores, combined with a significant p-value, indicates that strategic planning effectively enhanced the service quality as perceived by the participants.

There was a significant difference in information quality between the pre-intervention (M=4.47, SD=0.501) and post-intervention (M=4.55, SD=0.407) conditions; t (89) = -3.17, p = 0.002. The mean difference was -0.08. The increase in mean scores, combined with a significant p-value, indicates that strategic planning effectively enhanced the information quality as perceived by the participants.

There was a significant difference in perceived usefulness between the pre-intervention (M=4.49, SD=0.495) and post-intervention (M=4.57, SD=0.402) conditions; t (89) = -3.83, p < .001. The mean difference was -0.08. The increase in mean scores, combined with a significant p-value, indicates that strategic planning effectively enhanced the perceived usefulness as experienced by the participants.

There was a significant difference in perceived ease of use between the pre-intervention (M=4.52, SD=0.503) and post-intervention (M=4.60, SD=0.401) conditions; t (89) = -3.42, p < .001. The mean difference was -0.08. The increase in mean scores, combined with a significant p-value, indicates that strategic planning effectively enhanced the perceived ease of use as experienced by the participants.

There was a significant difference in conformation between the pre-intervention (M=4.44, SD=0.525) and post-intervention (M=4.52, SD=0.45) conditions; t (89) = -3.69, p < .001. The mean difference was -0.08. The increase in mean scores and a significant p-value indicate that strategic planning effectively enhanced the sense of confirmation as perceived by the participants.

There was a significant difference in satisfaction between the pre-intervention (M=4.46, SD=0.529) and post-intervention (M=4.59, SD=0.403) conditions; t (89) = -4.14, p < .001. The mean difference was -0.13. The increase in mean scores and a significant p-value indicate that strategic planning effectively enhanced the participants' satisfaction.

In summary, the paired samples t-test results for all seven variables—System Quality, Service Quality, Information Quality, Perceived Usefulness, Perceived Ease of Use, Confirmation, and Satisfaction—demonstrated statistically significant improvements in mean scores and reduced standard deviations post-intervention, indicating that the strategic planning effectively enhanced users' perceptions and experiences with Tencent Meeting.

5. Conclusions, Recommendations and Limitations

5.1 Conclusions & Discussions

The study conducted at Guangdong City Technician College aimed to explore and enhance factors influencing student satisfaction with e-learning systems, particularly focusing on Tencent Meeting. The research was structured in three stages: pre-strategic planning, strategic planning, and post-strategic planning. The study utilized established models to identify key independent variables (system quality, service quality, information quality, perceived usefulness, perceived ease of use, and confirmation) that significantly impact student satisfaction.

The findings from the pre-strategic planning phase highlighted areas needing improvement. Based on this, strategic interventions were designed and implemented. These interventions, which included enhancements in the user interface, functionality, content quality, and overall user experience, were part of an iterative process. The post-strategic planning phase involved reassessing these factors using paired sample t-tests, demonstrating significant improvements across all variables. This confirmed that strategic planning effectively increased the quality and satisfaction of the e-learning experience, highlighting the ongoing nature of the study's approach.

The results of this study highlight significant implications for educational institutions and e-learning platforms. The post-intervention improvements in system quality underscore the critical need for stable and reliable technical infrastructure to address issues like video lag and audio quality, thereby enhancing satisfaction. Effective

customer support services were pivotal in improving service quality, emphasizing the importance of timely resolution of technical issues. Enhanced information quality through regular content updates is crucial to maintaining relevance and engagement. Improved perceived usefulness and ease of use suggest that user-friendly design and practical functionalities are essential for effective e-learning experiences. Higher levels of confirmation and satisfaction indicate that strategic interventions aligned well with student expectations, underscoring the value of iterative improvements informed by user feedback. Adopting structured strategic planning processes and continuous improvement strategies can enhance e-learning environments, ensuring ongoing satisfaction and effectiveness.

5.2 Recommendations

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The results of this study highlight significant implications for educational institutions and e-learning platforms. The post-intervention improvements in system quality underscore the critical need for stable and reliable technical infrastructure to address issues like video lag and audio quality, thereby enhancing satisfaction. Effective customer support services were pivotal in improving service quality, emphasizing the importance of timely resolution of technical issues. Enhanced information quality through regular content updates is crucial to maintaining relevance and engagement. Improved perceived usefulness and ease of use suggest that user-friendly design and practical functionalities are essential for effective e-learning experiences. Higher levels of confirmation and satisfaction indicate that strategic interventions aligned well with student expectations, underscoring the value of iterative improvements informed by user feedback. Adopting structured strategic planning processes and continuous improvement strategies can enhance e-learning environments, ensuring ongoing satisfaction and effectiveness.

5.3 Limitations for Future Research

This study has several limitations that should be considered. Firstly, it was confined to Guangdong City Technician College and focused solely on Tencent Meeting, limiting the generalizability of the findings. The sample size of 90 students and qualitative input from only three teachers and six students may not fully capture the population's diversity, affecting the robustness of the conclusions. Additionally, the short-term assessment of the strategic interventions does not account for long-term sustainability or potential issues that may arise over time. The study's emphasis on quantitative data may have overlooked nuanced insights that could be captured through more in-depth qualitative research. External factors such as personal circumstances, internet connectivity, and technological proficiency were not extensively considered, potentially impacting the e-learning experience.

Future research should be comprehensive and wide-ranging to address the complex nature of e-learning satisfaction. Expanding to multiple institutions will enhance generalizability and validate findings across diverse educational settings. Investigating multiple e-learning platforms could identify strengths and weaknesses, guide institutions in platform selection, and inform developers on areas for improvement. Long-term studies are necessary to provide insights into the sustainability and effectiveness of strategic interventions over time. Incorporating more extensive qualitative methods would offer deeper insights into student and teacher experiences, uncovering subtle factors affecting satisfaction. Future research should also consider external factors like internet access and technological proficiency to understand their influence on e-learning satisfaction. Exploring the relationship between teaching methods and e-learning satisfaction could optimize the integration of technology and pedagogy. Examining the effects of targeted training programs on the use of e-learning platforms could enhance user experience and satisfaction. Conducting cross-cultural studies would reveal how cultural differences impact perceptions and satisfaction with e-learning systems, aiding in the development of culturally sensitive solutions. Addressing these limitations and pursuing these research directions would provide a more comprehensive understanding of e-learning satisfaction,

enabling institutions to create more effective and inclusive e-learning environments.

In conclusion, this study highlights the critical factors influencing e-learning satisfaction and demonstrates the effectiveness of strategic planning in enhancing the e-learning experience. By focusing on system quality, service quality, information quality, perceived usefulness, perceived ease of use, and confirmation, educational institutions can significantly improve student satisfaction with e-learning platforms.

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