

FACTORS IMPACTING STUDENTS' SATISFACTION WITH A DIGITAL LEARNING APPLICATION FOR KNOWLEDGE TRAINING IN CHENGDU, CHINA

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Received 18 June 2025

Revised 10 February 2026

Accepted 20 February 2026

Abstract

With the rapid expansion of digital learning in secondary education in China, training in knowledge applications is widely used to support teaching. However, schools and policymakers still face practical challenges in ensuring that these applications effectively enhance student satisfaction and learning outcomes. This study examines the factors influencing student satisfaction with the application of training knowledge among high school students in Chengdu, China. A quantitative research design was applied using a structured questionnaire administered to 367 students. Content validity was assessed through Item-Objective Congruence, and reliability was confirmed using Cronbach's alpha values above the acceptable threshold. Multiple linear regression analysis showed that service quality, information quality, system quality, social component, individual growth, and academic performance all significantly influenced student satisfaction ($p < .05$). The model explained 68.5 percent of the variance, with service quality and social component and individual growth as the strongest predictors. To address these practical concerns, a strategic intervention was implemented with a subgroup of 80 students. Paired-samples t-test results showed significant improvements in all variables and in overall satisfaction after the intervention ($p < .001$). The findings provide practical and policy-relevant insights for schools, educational administrators, and system developers.

Keywords: Satisfaction, Training Knowledge Application, Secondary Education

Introduction

Digital learning tools have increasingly transformed secondary education by providing more personalized, flexible, and interactive learning experiences (Abildinova et al., 2024). In China, this transformation has accelerated due to national policies that promote technology-enhanced education. Digital training applications that integrate artificial intelligence, big data, virtual reality, and augmented reality are now widely used in art training schools. These technologies support individualized instruction and creative skill development, which are essential in art education (Kovalenko et al., 2022).

Despite their widespread adoption, limited research has examined the effectiveness of digital training applications from the perspective of high school students. Existing studies have primarily focused on higher education or corporate training contexts and have emphasized system performance and learning outcomes (Kovalenko et al., 2022). As a result, student satisfaction and engagement in secondary art education remain underexplored. In particular, little attention has been given to how service quality, information quality, system quality, social and personal development, and academic performance shape students' learning experiences in creative digital environments.

The primary objective of this study is to examine the factors influencing high school students' satisfaction with a digital training application in an art training school in Chengdu, China. To address this objective, the study examines five key dimensions: service quality, information quality, system quality, social component and individual growth, and academic performance. These dimensions represent the core elements that influence satisfaction in creative digital learning contexts.

The findings extend digital satisfaction research into secondary art education and offer practical implications for educators, system developers, and policymakers seeking to improve digital learning tools that support student engagement and learning outcomes in skill-based programs.

Literature Review

1. Service Quality (SERQ)

Service quality refers to the ability to deliver services that meet users' expectations and support their development needs within an organization (Asubonteng et al., 1996). In educational contexts, it includes responsiveness, reliability, and effectiveness of services provided to students (Lin & Hsieh, 2006). Recent studies show that e-learning service quality, especially support responsiveness and administrative clarity, significantly enhances students' perceived value and satisfaction (Vu et al., 2025). Similarly, Almarashdeh (2021) found that prompt support and system reliability positively influence user satisfaction with e-learning platforms. Ozkan and Koseler (2022) further confirmed that service quality affects student

satisfaction through system support and problem resolution. However, limited research has examined whether these relationships hold in secondary art training contexts, where learning demands are skill-based and individualized. Therefore, this study hypothesizes that service quality is a significant determinant of student satisfaction.

H1: Service quality has a significant impact on satisfaction.

2. Information Quality (INFQ)

Information quality refers to the accuracy, relevance, completeness, and timeliness of information provided within an information system (Nelson et al., 2005). In educational settings, high-quality information enhances perceived usefulness and credibility of digital platforms. English (2009) emphasized that information must be fit for its intended purpose to be considered high quality. More recently, Mirabogasemi et al. (2021) found that well-structured learning materials significantly improve student engagement and satisfaction. Vu et al. (2025) also highlighted that clarity and usefulness of system output directly affect satisfaction. Despite these findings, empirical evidence on information quality and satisfaction among high school students in creative learning environments remains limited. Accordingly, this study proposes information quality as a key predictor of student satisfaction.

H2: Information quality has a significant impact on satisfaction.

3. System Quality (SYSQ)

System quality refers to the performance level and technical functionality provided by an information system, including reliability, usability, and responsiveness (Wang et al., 2014). DeLone and McLean (1992) identified system quality as a core component of information system success due to its influence on user experience. Lederer et al. (2000) noted that system quality strongly predicts perceived usefulness in digital environments. Yüce et al. (2019) further found that system stability and ease of use significantly affect user satisfaction. However, most prior studies focus on higher education or general e-learning platforms rather than secondary-level training applications. This gap supports the examination of system quality as a determinant of satisfaction in the present study.

H3: System quality has a significant impact on satisfaction.

4. Social Component and Individual Growth (SCIG)

Social interaction and opportunities for personal development play an important role in shaping students' academic satisfaction. Chen et al. (2021) found that autonomy and institutional support in online learning environments enhance engagement and satisfaction. Al-Kahlan and Khasawneh (2023) showed that extracurricular involvement improves social skills and personal growth, leading to higher satisfaction. While these studies emphasize social and developmental factors, their role in digital training applications for secondary

students has received limited attention. Thus, this study considers social component and individual growth as important contributors to student satisfaction.

H4: Social component and individual growth have a significant impact on satisfaction.

5. Academic Performance (AP)

Academic performance refers to students' demonstrated learning outcomes, commonly evaluated through assessments and feedback. It is influenced by intrinsic motivation, psychological traits, and personal definitions of success (Wach et al., 2016). Realyvèsquez-Vargas et al. (2020) noted that academic performance reflects mastery of course content shaped by curriculum design and teaching quality. Access to digital learning tools may further influence performance, which in turn affects satisfaction. Nevertheless, few studies have explicitly tested the relationship between academic performance and satisfaction within digital training contexts at the secondary level. Therefore, academic performance is hypothesized as a significant predictor of student satisfaction.

H5: Academic performance has a significant impact on satisfaction.

6. Satisfaction (S)

Satisfaction refers to an individual's positive emotional response resulting from fulfilled expectations or needs. In education, it reflects the alignment between students' expectations and perceived learning value (Nagy, 2018). Astin (1993) viewed student satisfaction as an indicator of perceived benefits gained from the academic environment. Oliver (1993) described satisfaction as a psychological response following evaluative judgment, while Jadrić et al. (2025) emphasized positive learning interactions as a key source of satisfaction. In this study, satisfaction serves as the outcome variable through which the effects of system, service, academic, and social factors are examined.

Research Framework

This study draws upon four core theories to develop its conceptual framework: the Information System Success Model (ISSM), which highlights the importance of service quality, information quality, and system quality in influencing user satisfaction (DeLone & McLean, 1992); the Expectancy Confirmation Theory (ECT), which explains how satisfaction arises from the confirmation of users' expectations (Oliver, 1980); the Technology Acceptance Model (TAM), which emphasizes perceived usefulness as a driver of system use and satisfaction (Davis, 1989); and Artificial Neural Networks (ANN), used to understand complex, non-linear relationships among influencing factors in digital learning environments.

Integrating these theoretical perspectives with findings from prior empirical studies, the framework examines key factors, illustrated in Figure 1, as predictors of student satisfaction with digital training applications in Chengdu, China.

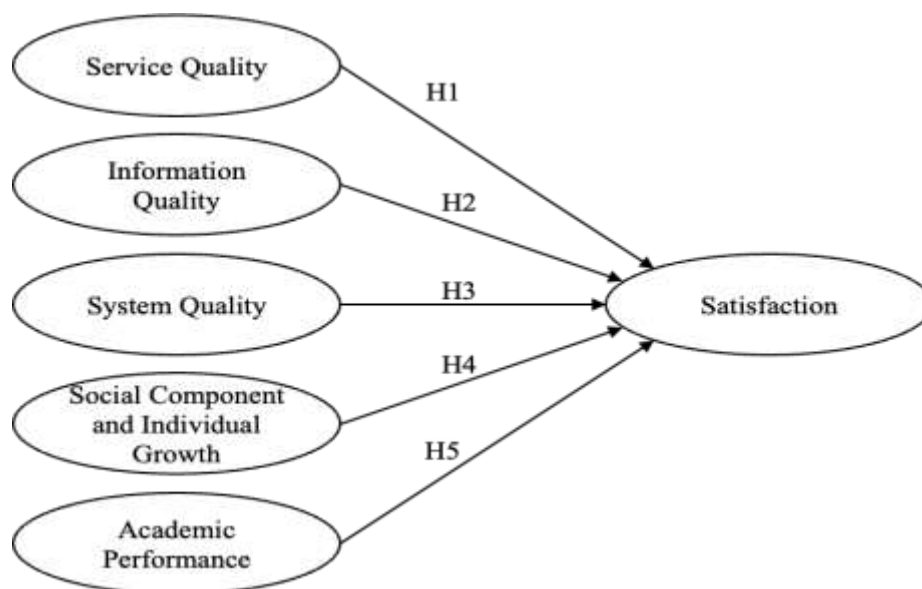


Figure 1 Conceptual Framework

Research Methodology

This study is structured into three key stages: pre-strategic planning, strategic planning, and post-strategic planning.

The pre-strategic planning stage involves identifying the study's vision, defining specific tasks, and recognizing key stakeholders. During this phase, the core variables of service quality, information quality, system quality, social component and individual growth, and academic performance are assessed. A SWOT analysis is also conducted to evaluate internal and external factors influencing the research context.

The strategic planning stage focuses on developing and implementing strategies to address identified issues and achieve the study's objectives.

The post-strategic planning stage involves reviewing, evaluating, and refining the strategies to enhance students' satisfaction with the use of training knowledge applications.

1. Research Population and Sample Size

The study targets high school students from XY Art Training School in Chengdu, including 120 first-year, 122 second-year, and 125 third-year students.

Following Hair et al. (2010), a sample size between 30 and 500 is appropriate for most studies. This research involved 80 participants in the pre-strategic phase (with 30 undergoing diagnostics), and 30 participants each in the strategic planning and post-strategic evaluation phases. This phased approach ensured continuity and reliable feedback across stages.

2. Sampling Procedures

This study adopted a combination of probability and non-probability sampling methods to support its quantitative design. Data were collected using a structured

questionnaire with a 5-point Likert scale, distributed online via Wenjuanxing. In Phase 1, purposive sampling was used to select participants with relevant experience for the pre-strategic planning stage. In Phase 2, stratified random sampling ensured proportional representation across grade levels during the strategic planning phase. In Phase 3, both purposive and convenience sampling were employed to efficiently gather responses in the post-evaluation stage.

Research Instrument

1. Questionnaire Design and Components

The questionnaire was developed to assess factors influencing students' satisfaction with the application of training knowledge, based on established constructs: service quality, information quality, system quality, social component, individual growth, academic performance, and satisfaction. Content validity was confirmed using the Item-Objective Congruence (IOC) method.

The questionnaire comprises three sections. The first includes screening questions on nationality and experience with training knowledge applications. The second gathers demographic information. The third consists of scaled items measuring the six constructs: Service Quality (4 items), Information Quality (3 items), System Quality (3 items), Social Component and Individual Growth (6 items), Academic Performance (3 items), and Satisfaction (3 items), using a 5-point Likert scale.

2. Reliability and Validity

Content validity was established using the Item-Objective Congruence (IOC) method, with three academic experts evaluating each item. All items achieved IOC scores above 0.67, meeting the recommended threshold (Rovinelli & Hambleton, 1977).

A pilot test with 80 respondents was conducted to assess internal consistency. Cronbach's alpha values for all constructs met the minimum acceptable level of 0.60 for exploratory research (Hair et al., 2010), including Service Quality (0.757), Information Quality (0.733), System Quality (0.692), Social Component and Individual Growth (0.814), Academic Performance (0.628), and Satisfaction (0.635).

Results and Discussion

1. Demographic Information

The main research population consisted of 367 high school students from XY Art Training School in Chengdu, including 120 first-year, 122 second-year, and 125 third-year students. Gender distribution in this group reflected the school's overall demographic balance, with approximately 71% female (261) and 29% male (106).

Separately, a sample of 80 students participated in the strategic planning intervention phases. Among these 80 participants, 57 were female (71.25%) and 23 were male (28.75%), with proportional representation across all grade levels.

2. Multiple Linear Regression

Multiple linear regression (MLR) analysis was conducted using Jamovi to test the influence of five independent variables on the dependent variable, satisfaction.

The results indicate that all five variables significantly predict student satisfaction, with p-values below 0.05. The model explains 68.5% of the variance in satisfaction, suggesting a strong overall fit. Among the predictors, service quality ($\beta = 0.272$) and the social component and individual growth ($\beta = 0.256$) showed the highest standardized effects, highlighting their key roles in shaping student satisfaction with the application of training knowledge.

Table 1: MLR of Five Independent Variables on Satisfaction (n=367)

Variable	Standardized Estimate (β)	t-value	p-value	R ²
Service Quality (SERQ)	0.272	4.953	< .001*	0.685
Information Quality (INFQ)	0.132	2.659	.008*	
System Quality (SYSQ)	0.159	3.282	.001*	
Social Component & Individual Growth (SCIG)	0.256	4.454	< .001*	
Academic Performance (AP)	0.105	2.075	.039*	

Note: R² refers to the overall model explanatory power. p < .05*.

Based on these findings, the results of the multiple linear regression serve as a foundation for the next phase of the study, the strategic planning intervention. The significant influence of all five predictors on student satisfaction justifies further investigation into whether these factors improve following intervention efforts. Accordingly, the following additional hypotheses are proposed for testing in the next stage:

H6: There is a significant difference between the pre- and post-strategic plan for service quality.

H7: There is a significant difference between the pre- and post-strategic plan for information quality.

H8: There is a significant difference between the pre- and post-strategic plan for system quality.

H9: There is a significant difference between the pre- and post-strategic plan for social component and individual growth.

H10: There is a significant difference between the pre- and post-strategic plan for Academic Performance.

H11: There is a significant difference between the pre- and post-strategic plan for satisfaction.

3. Strategic Plan Intervention Stage

The final intervention model was developed to address key factors identified in the multiple linear regression analysis, namely service quality, information quality, system quality, social component and individual growth, and academic performance, all of which significantly influence student satisfaction. The model illustrated in Figure 2 guides the transition from the current situation to the expected improvement in satisfaction.

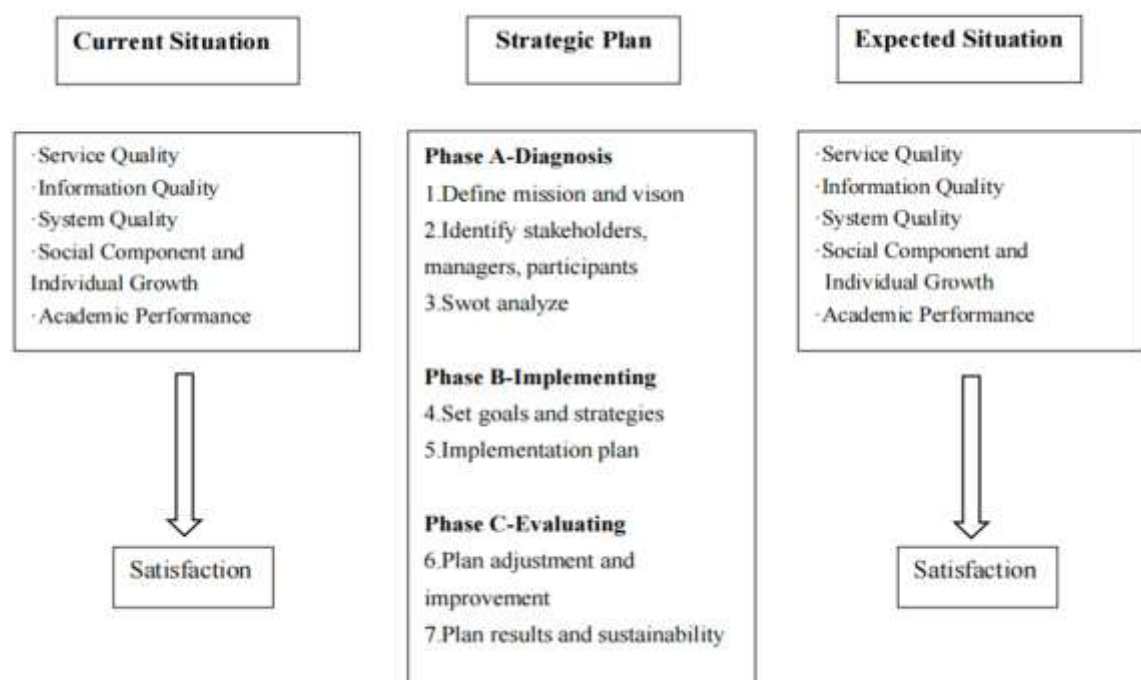


Figure 2: Final Determination of the Strategic Planning Model

4. Results Comparison between Pre- and Post-Strategic Plan

A paired sample t-test was conducted to compare participants' responses before and after the strategic planning intervention. The results in Table 2 show significant improvements across all six measured variables.

Table 2: Paired-sample T-test Results (n=80)

Variable		Mean	Std. Deviation	t-value	p-value
Service Quality	Pre-SP	3.20	1.13	-5.03	<.001
	Post-SP	3.55	0.920		
Information Quality	Pre-SP	3.22	1.19	-4.12	<.001
	Post-SP	3.58	0.94		
System Quality	Pre-SP	3.13	1.15	-4.38	<.001
	Post-SP	3.53	0.914		
Social Component & Individual Growth	Pre-SP	3.16	1.17	-4.14	<.001
	Post-SP	3.43	1.00		
Academic Performance	Pre-SP	2.99	1.17	-4.41	<.001
	Post-SP	3.29	0.96		
Satisfaction	Pre-SP	3.47	0.66	-7.70	<.001
	Post-SP	3.95	0.40		

The results of the paired sample t-test indicate statistically significant improvements across all six measured variables following the implementation of the strategic plan.

Students reported higher perceptions of service quality, information quality, and system quality (all $p < .001$), suggesting that the intervention effectively addressed key system-related elements, such as responsiveness, content clarity, and platform usability.

In addition, significant gains were observed in the social component and individual growth and academic performance ($p < .001$), indicating that the strategic plan contributed to enhanced student engagement, personal development, and perceived academic outcomes.

Importantly, overall satisfaction also increased significantly ($t = -7.70$, $p < .001$), highlighting the comprehensive impact of the intervention on students' experiences with applying the training knowledge. These findings confirm that the strategic plan successfully improved both the technical and learner-centered dimensions of the application, aligning with the initial regression results and validating the targeted intervention approach.

Conclusions, Recommendations, Limitations, and Future Research

1. Conclusions

This study examined the factors influencing students' satisfaction with a digital training knowledge application and evaluated the effectiveness of a strategic intervention. The findings confirm that service quality, information quality, system quality, social

component, individual growth, and academic performance all significantly contribute to student satisfaction. These results align with the Information System Success Model (DeLone & McLean, 1992), which emphasizes system, service, and information quality as core drivers of user satisfaction, and support the Expectancy-Confirmation Theory (Oliver, 1980) by showing that perceived improvements in these areas enhance learner satisfaction. Together, these findings reinforce the view that satisfaction in digital learning environments is a multidimensional construct shaped by both technological performance and users' evaluative judgments of value and outcomes.

In practice, the intervention demonstrated that enhancing these factors leads to measurable gains in satisfaction, as evidenced by post-intervention improvements across all variables. For instance, improvements in service quality and system quality contributed to a more user-friendly and engaging interface, which is consistent with previous studies emphasizing usability and responsiveness (Almarashdeh, 2021; Ozkan & Koseler, 2022). Similarly, improving information quality enhanced content relevance and learner motivation, echoing findings from Mirabogasemi et al. (2021). These results empirically validate key assumptions of the ISSM by demonstrating how quality improvements translate into positive user evaluations in a secondary education setting.

The study also extends current literature by highlighting the role of social engagement and personal growth in a high school context, an area often underexplored in prior research. This finding complements the Technology Acceptance Model (TAM) by suggesting that perceived usefulness in educational systems extends beyond functional efficiency to include opportunities for social interaction, self-expression, and developmental support. This reinforces the need to conceptualize satisfaction beyond system usability alone.

Additionally, academic performance emerged as a key contributor to satisfaction, underscoring the importance of integrating digital tools that support learning outcomes and personalized feedback. This result supports expectancy-based theories by indicating that satisfaction increases when digital learning tools help students achieve tangible academic goals.

Theoretically, the study integrates elements from TAM, ISSM, and ECT to demonstrate how digital learning environments can be optimized across technical, content, and developmental dimensions. By empirically linking system quality constructs with learning-related outcomes and social-developmental factors, the study broadens the explanatory scope of existing satisfaction models in the context of secondary education. Practically, the findings offer clear implications for developers, educators, and school administrators: improving the digital learning experience requires not only robust systems

and accurate information but also features that foster student agency, social interaction, and performance tracking.

Despite challenges such as personalization complexity, uneven engagement, and resource demands, the strategic plan proved effective in enhancing students' satisfaction. Future research should further refine integrated theoretical models by examining how these factors interact over time and across different educational contexts. Future efforts should also focus on iterative design, sustained teacher-student collaboration, and adaptive content delivery to build more inclusive and engaging digital learning environments.

2. Recommendations

Based on the findings, improving service quality, information quality, system quality, the social component, individual growth, and academic performance can significantly enhance students' satisfaction with the application of training knowledge. The following recommendations are proposed to guide future implementation and development.

To improve service quality, efforts should focus on functional optimization, interactive enhancement, and personalization. Features such as reward-based incentives (e.g., virtual coins or customizable avatars) can boost engagement and motivation. Additionally, responsive support systems and real-time interaction tools can enrich the service experience.

Enhancing information quality requires content accuracy, relevance, and interactivity. Teachers and students should be encouraged to co-create and share high-quality learning content. Schools can also integrate after-class sessions in which educators clarify key topics, reinforcing students' understanding and encouraging application.

To strengthen system quality, the user interface should be simplified and made more intuitive. Prioritizing frequently used features like practice modules and resource libraries improves accessibility. Adding a "My Favorites" section can streamline access to learning materials. A well-designed feedback function should also be integrated to capture user suggestions and ensure continuous system improvement and stability.

Enhancing the social component and personal growth involves fostering peer interaction and self-expression. Interactive spaces such as digital labs or community forums can support collaboration, feedback, and confidence-building. Promoting student participation in community activities and peer management roles can further cultivate leadership and social responsibility.

To support academic performance, personalized learning strategies and psychological support are essential. Interactive tools such as real-time Q&A, study groups, and adaptive content delivery can provide timely feedback and boost learning outcomes. Data-driven analytics should also be used to tailor learning paths, allowing students to receive customized support based on their progress and needs.

Collectively, these recommendations aim to create a more engaging, supportive, and learner-centered digital environment that enhances satisfaction and educational outcomes.

3. Limitations and Future Research

This study presents several limitations that offer directions for future research. First, the multiple linear regression analysis was based on data from a single institution, limiting the generalizability of findings. Although the identified variables showed significant effects on student satisfaction, other relevant factors may have been excluded. Future studies should include larger and more diverse student samples across multiple schools to enhance the robustness and applicability of the results.

Second, the intervention was conducted with students in the same painting major, enabling a more uniform and targeted strategic plan. However, this limits the model's adaptability to other disciplines. Future research should explore customized intervention strategies tailored to students from different academic backgrounds to better understand discipline-specific needs and ensure broader applicability.

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