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INFLUENCES OF DIGITAL LEADERSHIP ON THE EFFECTIVENESS OF ART
EDUCATION IN UNIVERSITIES UNDER SHENYANG CITY

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Abstract

This research aimed to examine the concepts, variables, and components of digital leadership and the effectiveness of art education in universities under Shenyang City, as well as to investigate the influence of digital leadership on the effectiveness of art education. A mixed-methods approach, including qualitative and quantitative research, was employed. The study population included 2,024 professional instructors and instructional administrators from 16 universities in Shenyang City. The sample size of 354 was determined using G*Power and was selected through stratified random sampling. Additionally, 7 experts were chosen via purposive sampling. Research instruments consisted of in-depth interviews and a five-point Likert scale. Data analysis methods such as exploratory factor analysis and multiple regression analysis were applied. The findings revealed that the digital leadership of art education in Shenyang universities consisted of five components and 86 variables, while the effectiveness of art education comprised five components and 84 variables. Digital adaptation and innovation had significant positive effects on multiple aspects of the effectiveness of art education, and digital culture construction exerted substantial influence on university efficiency. Different dimensions of digital leadership had varying effects on the effectiveness of art education at different levels. Based on these results, targeted

suggestions were proposed for policy formulation, practical application, and follow-up research.

Keywords: Digital Leadership, Effectiveness, Art Education, Universities under Shenyang City

Introduction

1. Research Background

In the digital age, digital technology profoundly changed the way people lived, worked, and structured society, driving digital transformation on a global scale. Digital transformation was not merely the application of technology but a cultural and strategic shift that affected various sectors, including business, healthcare, education, and government. As digitalization accelerated, digital leadership emerged as a crucial factor in the success of organizational transformation. Digital leadership required leaders not only to possess knowledge of digital technology but also to demonstrate strategic thinking, innovation, decision-making, and team management abilities to adapt to the complex and dynamic digital environment.

In the field of education, digital leadership was particularly significant. The widespread adoption of digital technology fundamentally altered the way educational resources were accessed and facilitated innovations in teaching models. However, the digital transformation of education faced challenges such as the digital divide, information security, and privacy protection. These challenges were even more pronounced in higher education institutions specializing in arts education, where the unique characteristics of artistic disciplines placed higher demands on digital leadership. As a major cultural and economic center in northeastern China, Shenyang possessed abundant resources for higher education in the arts. Therefore, improving the management of arts education through digital leadership and enhancing educational quality became pressing concerns for university administrators. This study focused on digital leadership in the context of arts education in Shenyang's universities, analyzing its impact on educational effectiveness and proposing corresponding optimization strategies.

2. Research Questions

What are the concepts and variables of digital leadership and effectiveness of art education in universities under Shenyang city? What are the components of digital leadership and effectiveness of art education in universities under Shenyang city? What are

the influences of digital leadership on the effectiveness of art education in universities under Shenyang city?

3. Research Objectives

To examine the concepts and variables of digital leadership and effectiveness of art education in universities under Shenyang city. To explore the components of digital leadership and effectiveness of art education in universities under Shenyang city. To investigate the influences of digital leadership on the effectiveness of art education in universities under Shenyang city.

4. Research Significance

This study held significant importance in promoting the digital transformation of higher education in the arts. From a theoretical perspective, exploring the role of digital leadership in arts education contributed to enriching the theoretical framework of digital leadership and deepening the understanding of the relationship between digital transformation and educational management. From a practical standpoint, universities in Shenyang faced dual challenges in transitioning their management models and innovating teaching methodologies. Investigating the application of digital leadership provided scientific decision-making support for university administrators, optimized the allocation of educational resources, facilitated interdisciplinary collaboration, and enhanced the implementation of personalized learning. Furthermore, improving digital leadership helped strengthen the internationalization of education by enabling universities in Shenyang to connect with global arts education resources and offer students a more diverse learning experience. Additionally, by identifying the influencing factors and development paths of digital leadership, this study provided valuable insights for other higher education institutions, contributing to the modernization of education. In conclusion, this research not only supported the high-quality development of arts education in Shenyang's universities but also offered important references for the broader digital transformation of higher education.

Literature Review

1. Digital leadership

Digital leadership has become an essential aspect of organizational management, particularly in the context of rapid technological advancements and the rise of the digital economy. With digitalization reshaping business operations, traditional leadership models

are being redefined to align with new digital demands. Leaders now must embrace digital strategic thinking, control the digital environment, foster organizational reforms, develop talent digitally, and enhance communication within a digital context (Li & Miao, 2022). Digital leadership is crucial for organizations to remain competitive, as it enables them to leverage digital tools to create meaningful, transparent, and influential cultures. In universities, this concept is similarly critical, as it impacts the digital transformation of educational institutions, the training of high-quality digital talents, and the creation of a dynamic learning environment (Chen & Zhou, 2020). Effective digital leadership in universities requires a focus on technology, culture, and the humanities, fostering an innovative, adaptable, and collaborative environment (Zhan & Jiang, 2023).

In the digital era, the challenges faced by leaders are multifaceted, requiring not only technological skills but also cultural sensitivity and strategic insight (Qiu, 2021). As universities navigate these challenges, leaders are encouraged to implement systemic improvements, nurture a culture of learning, and support team growth to ensure that their institutions remain relevant in the digital age (Ju, 2016). Moreover, digital leadership is seen as a combination of key competencies such as mindful change ability, professional business capability, and environmental cognitive abilities, all of which are essential for success in the digital world (Duan, 2020). Research suggests that measuring and improving digital leadership involves understanding the internal and external factors influencing leadership effectiveness, such as innovation, management, and organizational strategy (Miao, 2018). These evolving leadership models are integral to fostering successful digital transformations in both enterprises and educational institutions, making digital leadership a cornerstone of organizational growth and innovation.

Effective ideological and political education requires educators to internalize and embody the principles they teach. In college ideological and political theory courses, instructors should not only be well-versed in Marxist theory but also integrate their life experiences to make lessons engaging, practical, and socially relevant. This approach helps bridge theoretical knowledge with real-world applications, ensuring students grasp the ideological significance of their education (Yuan, 2020). Additionally, fostering interdisciplinary exchanges among students can promote collaborative knowledge creation, broadening their perspectives and enhancing their adaptability to complex societal challenges (Chen, 2018). Universities in Shenyang must adopt innovative teaching methods

and interactive pedagogies to strengthen ideological education while maintaining high academic standards, ensuring holistic student development (Wang, 2019).

2. Effectiveness

Effectiveness theory, as defined in the Modern Chinese Dictionary, pertains to the degree to which planned activities achieve their expected outcomes. It emphasizes the assessment of operational efficiency within organizations or systems, focusing on resource utilization, performance evaluation, and adaptability to changes (Hu, 2018). In the context of education, effectiveness is linked to both student learning progress and organizational performance. From a teaching perspective, "effectiveness" means that students should not only learn more but also develop a love for learning, as noted by Yu Wensen (2013). Educational management also plays a pivotal role in improving effectiveness by establishing high-quality evaluation systems and nurturing talent (Li, 2021). The integration of various theories, such as evaluation and validity theory, has also contributed to refining the understanding and measurement of effectiveness, providing actionable frameworks for educators and administrators (Wallace, 2008; Zhan et al., 2023).

University effectiveness is a multifaceted concept that has been explored by several scholars. Mortimore (1988) argues that student progress is a key indicator of university effectiveness, while Seheerens (2000) broadens this definition, incorporating a university's ability to meet predetermined goals within its specific context. Zheng Yanxiang (2002) further expands university effectiveness into five dimensions: technical, economic, interpersonal, social, and educational efficiency. Other scholars such as Sun Miantao (2007) and Wen Hengfu (2007) focus on the role of universities in promoting staff development and achieving educational objectives. Additionally, Sun Hechuan (2011) highlights the importance of universities in fostering significant student progress, underscoring the value-added impact of educational institutions. These perspectives collectively contribute to a comprehensive understanding of university effectiveness, which, alongside efficiency, guides the continuous improvement of educational systems (Taylor & Francis, 2020; Sarid, 2022).

3. Universities under Shenyang City

Shenyang's universities play a critical role in advancing China's innovation-driven development strategy, as highlighted in the 19th National Congress report of the Communist Party of China. Innovation and entrepreneurship education in universities contribute significantly to fostering "mass entrepreneurship and innovation," thereby supporting the

nation's goal of becoming a global innovation powerhouse. Entrepreneurship competitions serve as a crucial mechanism for stimulating students' innovation and entrepreneurship potential, fostering their comprehensive and individual development while enhancing the entrepreneurial ecosystem of Shenyang (Wu & Pan, 2020). The introduction of the "Double First-Class" initiative in 2017 marked a new phase in higher education reform, emphasizing the cultivation of world-class universities and disciplines. However, amid this push for academic excellence, ideological and political education remains vital. Universities must ensure that while focusing on research and innovation, they continue to instill moral values and cultivate students who can contribute to the socialist cause in the new era (Hu et al., 2019; Liu & Zhang, 2021).

Research Methodology

The research on the influences of digital leadership on the effectiveness of art education in universities under Shenyang city employed a mixed methodology, combining quantitative and qualitative research. The details are as follows:

1. Research Design

Qualitative Research: In the initial stage, a semi - structured interview method was adopted. The researcher constructed a dimensional framework regarding digital leadership and art education effectiveness through literature review, and then conducted in - depth interviews with 7 key informants. These informants were from the art education field in Shenyang universities, including deans, directors, and instructors with rich experience.

Quantitative Research: In the second stage, based on the variables identified in the qualitative research, a questionnaire was developed. The questionnaire was used to collect data from a sample to determine the components of digital leadership and art education effectiveness and the influence of digital leadership on art education effectiveness.

2. Population and Sample Size

Population: The population mainly consisted of administrators and instructors from 16 art education universities in Shenyang City, with a total of 2,024 people (151 college administrators and 1,873 instructors).

Sample: The sample size was determined using G*Power. Initially, a sample size of 322 was calculated, and then it was increased by 10% to 354 samples. These samples were obtained through stratified random sampling to ensure diversity and representativeness.

3. Sampling Technique

Stratified random sampling was used. First, the 16 universities in Shenyang City were divided into different strata according to certain characteristics. Then, samples were randomly selected from each stratum to ensure that the sample could represent the entire population.

4. Research Instruments

Semi structured Interview Form: Used in the qualitative research stage to interview key informants. - Five - point Rating Scale Questionnaire: Composed of three parts. Part I is demographic variables, Part II is digital leadership variables (86 items), and Part III is effectiveness variables (84 items). The questionnaire's content validity was tested by five experts using the Item - Objective - Congruence (IOC) method, and its reliability was analyzed by Cronbach's Alpha.

5. Data Collection

Qualitative Data Collection: Interviews were conducted on the recommendation of the research committee. Before the interview, the researcher informed the interviewees of the purpose and determined the interview time. Interviews were carried out in various places like offices, conference rooms, and online conference rooms, with each interview lasting about 60 minutes.

Quantitative Data Collection: The researcher used Questionnaire Star to create the questionnaire. At the beginning of the questionnaire, the research purpose was described, and relevant concepts were explained. The researcher contacted teachers in the sample units through WeChat, Email, and telephone to coordinate data collection. Questionnaires were also released through online channels.

6. Data Analysis

Qualitative Data Analysis: The data collected from interviews were analyzed using the qualitative research data analysis and interpretation method proposed by Caspeken, which included establishing original records and systematic reconstruction, analysis, and interpretation of the data.

Quantitative Data Analysis: Statistical analysis software was used. First, the collected data were cleaned and organized. Demographic variables were analyzed using descriptive statistical methods. For other variables, the mean, standard deviation, and other indicators were calculated. Exploratory Factor Analysis (EFA) was used to explore the components of

digital leadership and art education effectiveness, and Multiple Regression Analysis (MRA) was used to investigate the influence of digital leadership on art education effectiveness.

Results and Discussion

Table 1 Shows the eigenvalues, percentage of variance, and cumulative percentage of variance of digital leadership components in universities under Shenyang City

Components	Rotation Sums of Squared Loading (Extraction Method: Principal Component Analysis)		
	Total	Percentage of Variance	Percentage of Cumulative
1. Digital Strategy	3.695	24.634	24.634
2. Digital Culture Building	3.106	20.706	45.34
3. Digital Cultural Transformation	2.946	19.64	64.98
4. Digital Adaptation and Innovation Drivers	0.852	5.681	70.661
5. Digital Decision-Making and Collaboration	0.766	5.106	75.767

Table 1 presents the results from the Principal Component Analysis (PCA) reveal the extraction of five significant components, as indicated by their eigenvalues, all of which are greater than 1.0. The first component has an eigenvalue of 3.695, explaining 24.634% of the variance. This indicates that the first component accounts for a significant portion of the data's variability. The second component, with an eigenvalue of 3.106, contributes an additional 20.706% to the explained variance, bringing the cumulative variance to 45.34%. The third component, with an eigenvalue of 2.946, contributes 19.64%, increasing the cumulative variance to 64.98%. As more components are added, the percentage of variance explained by each decrease, with the fourth component explaining 5.681% and the fifth component explaining 5.106%, bringing the cumulative variance to 75.767%. The high cumulative percentage suggests that these components capture most of the information in the data set, making them essential for understanding the underlying structure.

The distribution of variance across these components also indicates that the data has multiple dimensions, each contributing uniquely to the overall variability, which is important for the interpretability of the factors derived from the analysis.

Table 2 Shows the eigenvalues, percentage of variance, and cumulative percent of variance of effectiveness components in universities under Shenyang City

Components	Rotation Sums of Squared Loading (Extraction Method: Principal Component Analysis)		
	Total	Percentage of Variance	Percentage of Cumulative
1. Comprehensive Effectiveness Optimization	3.838	47.974	47.974
2. University Effectiveness	1.767	22.093	70.067
3. Holistic Educational Effectiveness	0.553	6.915	76.982
4. Integrated System Efficiency	0.47	5.872	82.853
5. Art Education Effectiveness	0.419	5.239	88.093

Table 2 presents the eigenvalues, percentage of variance, and cumulative percentage of variance for the effectiveness components in universities under Shenyang City. The first component has an eigenvalue of 3.838, which explains 47.974% of the total variance, making it the most significant factor. Together with the second component (eigenvalue 1.767, explaining 22.093% of the variance), these two components account for 70.067% of the total variance, indicating that the first two factors are crucial in explaining the majority of the variance in the data.

The remaining components have eigenvalues below 1, with the third, fourth, and fifth components explaining 6.915%, 5.872%, and 5.239% of the variance, respectively. While each of these components contributes to the overall model, their individual contributions are relatively smaller. The cumulative percentage of variance after the fifth component reaches 88.093%, which indicates that these five components together account for the majority of the variance, confirming that the factor structure effectively captures the key factors driving effectiveness in universities within Shenyang City.

Table 3 Multiple Regression Analysis of the Influencing Factors of Comprehensive Effectiveness Optimization

(n=354)

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	Durbin-Watson
1	0.263 ^a	0.069	0.062	1.013	1.807

Notes: a. Predictors: (Constant),X2,X3,X4

b. Dependent Variable: Y1

ANOVA ^a					
Model	Sum of Squares	df	Mean Square	F	Significance
Regression	236.114	5	47.223	6.642	.000 ^b
1 Residual	.000	397	.000		
Total	236.114	354			

Notes: a. Dependent Variable:Y1

b. Predictors: (Constant), X2,X3,X4

Coefficients ^a							
Model	Unstandardized Coefficients (B)	Standard Error	Standardized Coefficients (Beta)	t	Significance	Tolerance	VIF
(Constant)	2.463	.257		9.584	.000		
1 X2	.049	.056	.045	.873	.383	.862	1.161
X3	.087	.051	.091	1.724	.085	.833	1.200
X4	.203	.052	.202	3.936	.000	.888	1.127

Notes: A. Dependent Variable: Y1

Table 4 Multiple Regression Analysis of the Influencing Factors of University Effectiveness
(n=354)

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	Durbin-Watson
1	0.251 ^a	0.063	0.056	1.057	1.766

Notes: a. Predictors: (Constant),X1,X2,X5

b. Dependent Variable: Y2

ANOVA ^a					
Model	Sum of Squares	df	Mean Square	F	Significance
Regression	30.014	3	10.005	8.957	.000 ^b
1 Residual	445.685	399	1.117		
Total	475.699	354			

Notes: a. Dependent Variable:Y2

b. Predictors: (Constant), X1,X2,X5

Coefficients ^a							
Model	Unstandardized Coefficients (B)	Standard Error	Standardized Coefficients (Beta)	t	Significance	Tolerance	VIF
X1	.075	.056	.065	1.340	.181	.989	1.011
2 X2	.194	.058	.172	3.350	.001	.896	1.117
X5	.114	.050	.117	2.295	.022	.902	1.108

Notes:A.Dependent Variable: Y2

Table 5 Multiple Regression Analysis of the Influencing Factors of Holistic Educational Effectiveness

(n=354)

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	Durbin-Watson
1	0.311 ^a	0.097	0.090	0.992	1.723

Notes: a. Predictors: (Constant),X3,X4,X5

b. Dependent Variable: Y3

ANOVA ^a					
Model	Sum of Squares	df	Mean Square	F	Significance
Regression	42.067	3	14.022	14.252	.000 ^b
3 Residual	392.560	399	.984		
Total	434.628	354			

Notes: a. Dependent Variable:Y3

b. Predictors: (Constant), X3,X4,X5

Coefficients ^a							
Model	Unstandardized Coefficients (B)	Standard Error	Standardized Coefficients (Beta)	t	Significance	Tolerance	VIF
(Constant)	2.248	.243		9.245	.000		
3 X3	.096	.049	.101	1.954	.051	.850	1.177
X4	.239	.050	.239	4.786	.000	.909	1.100
X5	.074	.046	.080	1.611	.108	.922	1.085

Notes: A.Dependent Variable: Y3

Table 6 Multiple Regression Analysis of the Influencing Factors of Integrated System Efficiency

(n=354)

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	Durbin-Watson
1	0.339 ^a	0.115	0.109	1.035	1.745

Notes: a. Predictors: (Constant),X1,X3,X4

b. Dependent Variable: Y4

ANOVA ^a					
Model	Sum of Squares	df	Mean Square	F	Significance
Regression	55.601	3	18.534	17.314	.000 ^b
Residual	427.096	399	1.070		
Total	482.696	354			

Notes: a. Dependent Variable:Y4

b. Predictors: (Constant), X1,X3,X4

Coefficients ^a							
Model	Unstandardized Coefficients (B)	Standard Error	Standardized Coefficients (Beta)	t	Significance	Tolerance	VIF
(Constant)	1.805	.281		6.411	.000		
X1	.069	.055	.060	1.241	.215	.962	1.039
X3	.186	.050	.185	3.727	.000	.896	1.116
X4	.226	.052	.214	4.317	.000	.899	1.112

Notes: A. Dependent Variable: Y4

Table 7 Multiple Regression Analysis of the Influencing Factors of Art Education Effectiveness

(n=354)

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	Durbin-Watson
1	0.145 ^a	0.021	0.014	1.061	1.626

Notes: a. Predictors: (Constant),X2,X4,X5

b. Dependent Variable: Y5

ANOVA^a

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	Durbin-Watson
1	0.145 ^a	0.021	0.014	1.061	1.626

Notes: a. Predictors: (Constant),X2,X4,X5

b. Dependent Variable: Y5

Coefficients^a

Model	Unstandardized Coefficients (B)	Standard Error	Standardized Coefficients (Beta)	t	Significance	Tolerance	VIF
(Constant)	2.861	.278		10.288	.000		
X2	.101	.059	.101	1.022	.982	.859	1.164
X4	.117	.053	.113	2.218	.027	.940	1.064
X5	.076	.050	.079	1.520	.129	.901	1.109

Notes: A.Dependent Variable: Y5

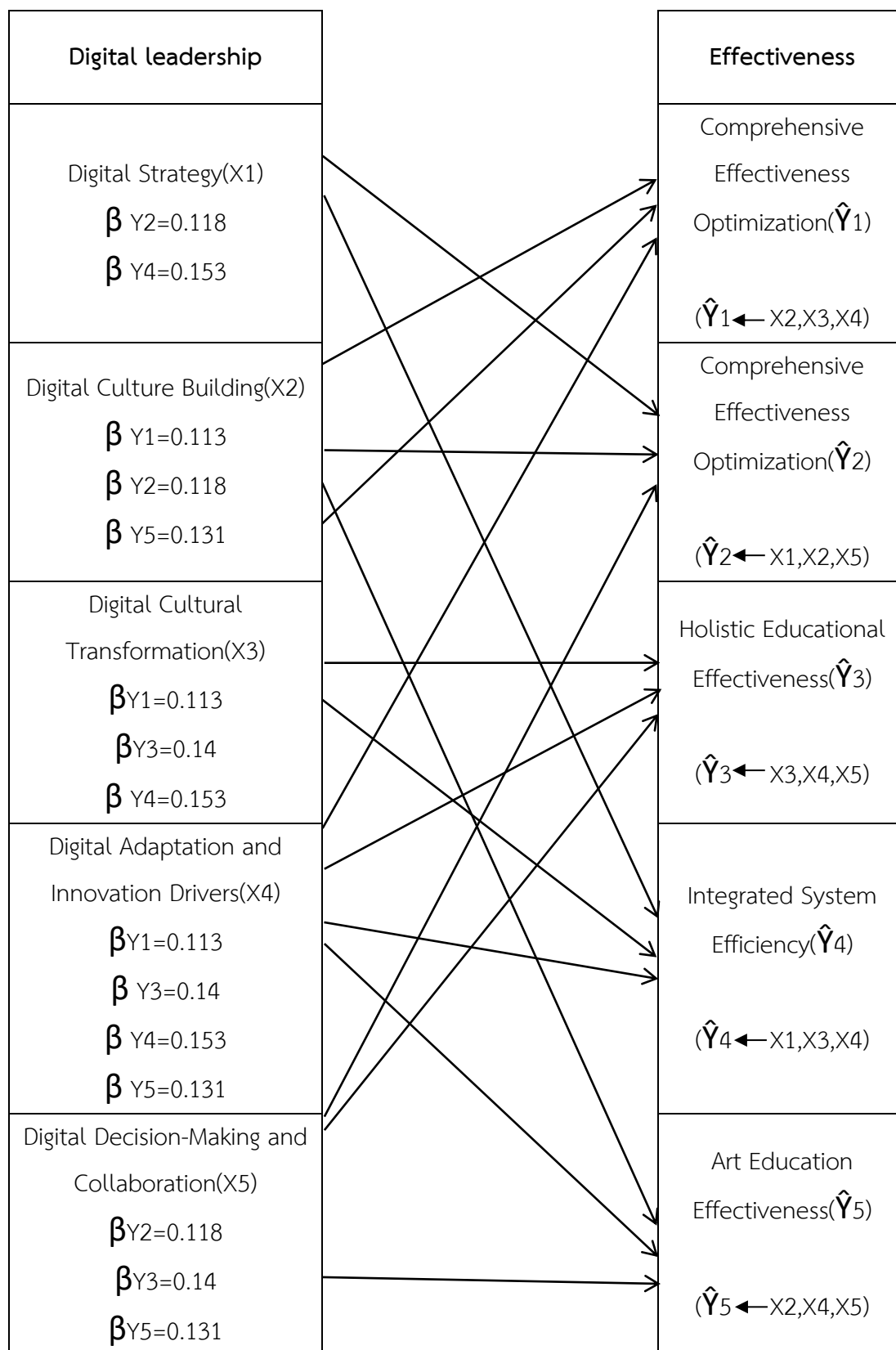


Figure 1 Components of the independent variables and the dependent variable have a mutual influence relationship.

The study investigated the effects of various dimensions of digital leadership on different aspects of the effectiveness of arts education through multiple regression analysis, revealing significant differences. According to Table 3-7 and Figure 1:

In terms of comprehensive efficiency optimization, a model using digital culture construction (X2), digital culture transformation (X3), and digital adaptation and innovation (X4) as predictor variables had an R value of 0.263, R^2 of 0.069, and an adjusted R^2 of 0.062. Among these, digital adaptation and innovation (X4) had the most significant impact (Beta = 0.202, $t = 3.936$, $p = 0.000$), followed by digital culture transformation (X3) with a moderate effect (Beta = 0.091, $t = 1.724$, $p = 0.085$), and digital culture construction (X2) with a minimal impact (Beta = 0.045, $t = 0.873$, $p = 0.383$).

At the university efficiency level, a model using digital strategy (X1), digital culture construction (X2), and digital decision-making and collaboration (X5) as predictor variables showed an R value of 0.251, R^2 of 0.063, and an adjusted R^2 of 0.056. Digital culture construction (X2) had the greatest influence (Beta = 0.172, $t = 3.350$, $p = 0.001$), followed by digital decision-making and collaboration (X5) with a moderate role (Beta = 0.117, $t = 2.295$, $p = 0.022$), while digital strategy (X1) had no significant effect (Beta = 0.065, $t = 1.340$, $p = 0.181$).

For overall educational effectiveness, a model consisting of digital culture transformation (X3), digital adaptation and innovation (X4), and digital decision-making and collaboration (X5) as predictors yielded an R value of 0.311, R^2 of 0.097, and an adjusted R^2 of 0.090. Digital adaptation and innovation (X4) was a key factor (Beta = 0.239, $t = 4.786$, $p = 0.000$), while digital culture transformation (X3) had a moderate influence (Beta = 0.101, $t = 1.954$, $p = 0.051$), and digital decision-making and collaboration (X5) had a weaker effect (Beta = 0.080, $t = 1.611$, $p = 0.108$).

Regarding comprehensive system efficiency, a model incorporating digital strategy (X1), digital culture transformation (X3), and digital adaptation and innovation (X4) as predictors achieved an R value of 0.339, R^2 of 0.115, and an adjusted R^2 of 0.109. Digital adaptation and innovation (X4) had a significant impact (Beta = 0.214, $t = 4.317$, $p = 0.000$), followed by digital culture transformation (X3) with substantial importance (Beta = 0.185, $t = 3.727$, $p = 0.000$), while digital strategy (X1) had a weaker influence (Beta = 0.060, $t = 1.241$, $p = 0.215$).

In the arts education efficiency dimension, a model comprising digital culture construction (X2), digital adaptation and innovation (X4), and digital decision-making and collaboration (X5) as predictors reported an R value of 0.145, R^2 of 0.021, and an adjusted R^2 of 0.014. Digital adaptation and innovation (X4) exhibited a moderate effect (Beta = 0.113, $t = 2.218$, $p = 0.027$), digital decision-making and collaboration (X5) had a weaker impact (Beta = 0.179, $t = 1.520$, $p = 0.129$), and digital culture construction (X2) showed no significant influence (Beta = 0.101, $t = 1.022$, $p = 0.982$).

Conclusions and Recommendations

1. Conclusions

This study explored digital leadership in art education at universities in Shenyang using a qualitative research approach. First, a comprehensive literature review was conducted to establish a theoretical foundation. Subsequently, the research team interviewed seven experienced educators, analyzed the data, and identified 86 variables related to digital leadership and 84 variables associated with the effectiveness of art education. Two five-point Likert scale questionnaires were developed and validated using the IOC method and Cronbach's Alpha to ensure reliability and validity. Exploratory factor analysis identified five key components of digital leadership (digital strategy, culture building, cultural transformation, adaptation and innovation, and decision-making and collaboration) and five major components of art education effectiveness (comprehensive performance optimization, university efficiency, overall educational effectiveness, system efficiency, and art education efficiency). Multiple regression analysis revealed that digital adaptation and innovation had the most significant impact on educational effectiveness, followed by digital cultural transformation, while digital culture building had minimal influence.

The findings provided a quantitative basis for university administrators, highlighting the critical role of digital leadership—particularly adaptation and innovation—in enhancing the quality of art education and guiding digital development strategies.

2. Recommendation for Policies Formulation

Cultivating Digital Leadership: Shenyang universities were encouraged to implement mandatory digital leadership training for art educators, focusing on digital strategy and market trend analysis. Incentive mechanisms, such as career advancement opportunities

and internal awards, were introduced to motivate participation. Additionally, universities were advised to allocate 10-15% of their professional development budget to ensure sustained digital leadership training.

Enhancing Digital Art Education Resources: Funding was allocated for creating digital art libraries and virtual galleries to enrich educational resources. A shared platform was established for universities to access and contribute high-quality digital materials, ensuring peer-reviewed accuracy and relevance. Incentives, including grants and awards, encouraged institutions to develop innovative resources like interactive 3D art lessons.

Strengthening Governance and Evaluation: Quality standards were defined for digital art courses, covering curriculum design, faculty-student interaction, and assessment methods. Regular evaluations assessed digital leadership implementation, resource usage, and student learning outcomes. Universities demonstrating excellence in digital art education received increased funding for research and infrastructure upgrades.

Promoting Equity in Digital Art Education: Financial support was provided to underfunded universities to enhance digital infrastructure, including high-speed internet and digital art tools. Targeted faculty training improved digital teaching skills, and partnerships between well-resourced and less-resourced institutions facilitated knowledge and resource sharing, ensuring equal access to quality digital art education.

Encouraging Innovation in Digital Art Education: Innovation grants funded experimental teaching methods, such as AR/VR integration in art education. Regulatory flexibility allowed for creative curriculum designs and experimental courses. An annual innovation award recognized outstanding digital art education initiatives, offering financial support and exposure at academic conferences to inspire further advancements.

3. Recommendation for Practical Application

Strategic Planning and Resource Optimization: Universities in Shenyang utilized digital leadership to develop targeted digital strategies for their art education programs. For instance, Lu Xun Academy of Fine Arts analyzed art market demands and student employment data to refine training goals for digital art professionals. By integrating internal and external resources through digital platforms, institutions eliminated information barriers, built collaborative networks, and optimized resource allocation based on student feedback.

Digital Culture and Innovation Ecosystem: Digital leadership fostered a digital culture that encouraged faculty and students to engage in creative activities. Shenyang

Conservatory of Music hosted digital art competitions and online exhibitions to spark innovation. Digital collaboration platforms facilitated cooperative learning, with faculty from Shenyang Normal University conducting research projects and students forming groups to complete creative tasks, enhancing teamwork and creativity.

Teaching Model Innovation and Cultural Transformation: Universities introduced VR and AR technologies to create immersive learning experiences. Institutions like Shenyang University and Shenyang University of Architecture used these tools in art history and design courses, boosting student engagement. Digital literacy courses were offered, teaching skills such as digital painting and 3D modeling, equipping students with essential competencies for the digital art industry.

Governance and Quality Assurance: Digital leadership enabled universities to establish governance frameworks for digital art education. Shenyang University of Technology developed regulations on digital copyright and online teaching standards. Digital technology supported quality monitoring, with institutions like Shenyang University of Chemical Technology analyzing student learning data to refine teaching methods and improve education quality.

Data-Driven Decision-Making: Universities built data collection systems to analyze student learning, faculty performance, and course effectiveness. Shenyang University of Science and Technology leveraged learning management platforms for data analysis, informing decisions on curriculum adjustments and faculty training. Strengthened supervision ensured effective implementation, enhancing overall education management.

4. Recommendation for Further Research

Expansion of Research Scope: This study focused on universities in Shenyang, but future research could have explored institutions in other regions. By comparing different economic and cultural contexts, researchers could have examined regional variations in the impact of digital leadership on art education. For example, a study could have compared universities in coastal and inland areas to analyze regional influences on digital leadership applications. Expanding the scope to vocational schools and training institutions could have provided a broader understanding of digital leadership in diverse educational settings.

Analysis of Influencing Factors and Mechanisms: While this study investigated digital leadership's impact on art education, further research could have explored additional influencing factors. School culture and policy environments might have interacted with

digital leadership, affecting educational outcomes. Advanced research methods, such as structural equation modeling and longitudinal studies, could have clarified causal relationships and mediating effects, offering a stronger empirical foundation for understanding how digital leadership shapes art education.

Long-Term Effects and Technological Evolution: As digital technologies evolved, the role of digital leadership in art education also changed. Future studies could have tracked how emerging technologies like artificial intelligence and blockchain influenced digital leadership's effectiveness over time. Research could have examined their long-term impact on student creativity and career development, providing strategic insights for sustainable digital art education planning.

Practical Application and Intervention Strategies: Based on this study's findings, future research could have developed targeted intervention strategies to enhance digital leadership in art education. Programs such as leadership training or optimized digital resource allocation could have been tested for effectiveness through action research. Evaluating these interventions could have provided practical guidance for improving art education administration and ensuring more effective implementation of digital leadership.

Interdisciplinary Research and Holistic Perspectives: Since digital leadership and art education intersected multiple disciplines, future studies could have integrated theories from education, psychology, management, and computer science. Research could have examined how digital environments influenced student motivation and cognition or how university management structures supported digital leadership. Interdisciplinary approaches could have led to a more comprehensive framework for understanding and applying digital leadership in art education.

As the digital age continues to advance, research on digital leadership and art education holds significant theoretical and practical importance. By exploring the above-mentioned directions for further research, it is hoped that deeper insights and more effective practical guidance can be provided for the field of art education. This would help promote the deep integration of digital technologies with art education, foster the cultivation of art talents with innovative spirit and digital literacy, and inject new vitality and momentum into the long-term development of art education.

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