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International Journal of Earthquake Engineering
Anno XLIII - Num. 1 - 2026

Digital Presentation and Communication Efficacy Enhancement of Traditional Cultural Elements in the Language Curriculum

Ying Xu[1,*]

[1] Basic Education Department, Henan Logistics Vocational College, Zhengzhou, Henan, 450003, China

SUMMARY: *This paper uses constructivist learning theory and media ecology theory as the guiding ideas, combines the mixed research method, and takes a quasi-experimental research approach to explore the effects of digital means in traditional culture education. Taking high school students as a sample for empirical research, the experimental class implemented teaching incorporating digital means such as VR technology, AR technology and multimedia interaction, while the control class conducted regular classroom lecture-style teaching, and carried out a 12-week teaching reform experiment involving three aspects of teaching ancient poems, teaching literary texts and traditional festival culture. This project used the questionnaire survey method, case interview method, case tracking method, and platform access statistics to obtain information data, and analyzed the data using a combination of qualitative and quantitative methods with the assistance of SPSS statistical software, which confirmed that the digital curriculum resources can effectively improve the students' level of knowledge of culture as well as their ability to understand culture, and enhance their interest in learning; at the same time, it has enlarged the scope of dissemination, improved the At the same time, the scope of dissemination has been expanded and the efficiency of dissemination has been improved, and the number of visitors has increased by nearly 13 times. Expanding from three provinces to the whole of China has increased the efficiency of dissemination by nearly 10 times. The case study also shows how VR, AR and multimedia technologies can be used in teaching and learning contexts.*

KEYWORDS: *traditional culture; digital presentation; virtual reality; augmented reality; multimedia technology*

1 Introduction

Under the background of cultural integration, China attaches great importance to the inheritance of traditional culture, so it is necessary to integrate traditional culture into the teaching of language courses to promote students to become the inheritors and disseminators of traditional culture, which helps to improve students' cognition of excellent traditional culture, feel the charm of traditional culture, and gradually form cultural self-confidence [1-4]. For the important role of traditional culture into language courses, literature [5] analyzed the important role of integrating excellent traditional culture into language courses on the mental health of college students, assessed the influencing factors through surveys, pointed out that it not only improves literary literacy, but also helps to build a healthy psychology, and emphasized the shortcomings of the current literature education and the direction of improvement. Literature

*xuying990816@163.com
https://doi.org/10.65102/is2026070 Published: 30 April, 2026

[6] examined the important role of integrating traditional culture in language courses, pointed out that it can enhance learning interest and national self-confidence, and emphasized the need for teachers to scientifically select the teaching content in order to cultivate composite talents with the ability of cultural communication. Literature [7] discusses the challenges of integrating Chinese culture in university language courses, and through surveys and interviews, points out the lack of standardized curricula, insufficient teaching methods and materials, etc. Based on the activity theory, it emphasizes the key role of effective integration of culture in language acquisition, and puts forward suggestions to optimize the curriculum content and teaching methods. Literature [8] analyzes the important role of traditional culture integration in language courses from the perspective of educational psychology, points out that it has a key influence on shaping students' positive personality and enhancing their moral and critical abilities, and emphasizes the necessity of a good educational environment to promote the development of college students' psychological health. Literature [9] studied the current situation and dilemma of traditional culture education in colleges and universities, examined its important role in university language teaching, and pointed out that it can shape moral personality and enhance humanistic literacy. However, the traditional mode of teaching is prone to make the cultural content seem detached and boring, and it is difficult to stimulate students' interest, while the development of digital technology provides support for the integration of language courses and traditional culture.

The application of digital technology is mainly to present traditional cultural elements in digital form in language courses, such as building traditional culture database and online library, building interactive learning platform, etc. [10, 11]. Databases and online libraries are able to preserve massive traditional cultural resources, and through audio-visual immersion, instant interaction, and contextual reproduction, they can effectively break down the spatial and temporal barriers to cultural understanding [12-14]. The interactive learning platform based on traditional culture is a learning space with traditional cultural elements as the main body, which can be configured with a knowledge mapping module to visualize and relate cultural concepts, such as displaying the knowledge network of poetry, ceramics, and etiquette derived from “tea culture” [15-16]; a collaborative inquiry module to support the group's on-line compilation of a dialect preservation e-zine; an instant feedback module through pop-ups; and an instant feedback module through pop-ups and pop-ups. The collaborative inquiry module supports groups to compile dialect preservation e-records online; the instant feedback module realizes the collision of views in the language classroom through pop-up discussions. This digital presentation of traditional cultural elements in the language curriculum also provides a broader space for the dissemination of traditional culture [17]. In the past, the dissemination of traditional culture was often limited to geography, time and audience groups [18]. Through the digital form into the language curriculum teaching, can effectively break through these limitations, not only in the teaching and dissemination, using the advantage of the immediacy of the digital platform can enhance the dissemination of efficiency, so that more people have the opportunity to contact and understand the traditional culture [19, 20].

Regarding the research on the role of digital dissemination of traditional culture in improving dissemination effectiveness, [21] examined the role of digital technology in improving the effectiveness of traditional culture dissemination in rural villages, and pointed out that it can effectively cope with the challenges of the lack of inheritance subjects by constructing a digital resource library and an immersive exploration platform, and emphasized the necessity and effectiveness of continuously optimizing the dissemination strategy by using new media. Literature [22] takes Shu brocade weaving technique as an example to explore the effectiveness assessment of traditional culture digital communication, establishes an assessment system through the Delphi method and hierarchical analysis, points out that the

indicators are shifting from focusing on technology to focusing on the authenticity of cultural connotations and skills inheritance, and emphasizes the systematic role of this method in promoting the sustainable development of traditional culture. Literature [23] analyzes the role of digital technology in enhancing the effectiveness of traditional culture communication, taking Huizhou traditional culture as an example, and points out that it can re-code and reconstruct traditional culture through the construction of databases and digital maps, and emphasizes that this strategy can effectively enhance the public cognition, thus promoting the inheritance and development of traditional culture in the contemporary era. Literature [24] analyzed the digital presentation of traditional Chinese dance culture, studied its influence on the cultural cognition of young people through the construction of digital museums, and emphasized the role of digital communication in enhancing the effectiveness of dance culture inheritance. Literature [25] studied the efficacy of applying VR technology to the digital communication of traditional opera culture, verified the positive impact of its perceived fun and ease of use on public acceptance through the technology acceptance model, and pointed out that the method can effectively enhance the communication effect, providing a reference for the digitization of other traditional cultural projects.

Based on constructivist learning theory and media ecology theory, this paper analyzes the technical realization path of digital presentation of traditional cultural elements in language curriculum and its mechanism of enhancing communication effectiveness through three core modules: experimental research, survey research and case study. Virtual reality, augmented reality, multimedia technology and other digital means are used to create an immersive cultural experience space for learners, aiming at proving through empirical analysis that the digital presentation technology has significant advantages and great potentials in enhancing the effectiveness of traditional cultural communication.

2 Research methodology

2.1 Study design

This paper adopts a quasi-experimental mixed research method as the main research path, and analyzes the influence of digital expressions of cultural symbols on learning effects and communication effects under the theoretical framework of constructivism and media ecology by using rigorous experimental processes and rich information collection means. The study is divided into three parts: the experimental part, the research part and the case study part, each of which has its own independent research objectives and complements the others to support a sufficient chain of evidence. The experimental part verifies the effects of the introduction of digital tools on students' academic performance; the research part explores students' subjective feelings and psychological change processes; and the case part summarizes the effective experiences and practices of implementing digital tools. The basic information is shown in Table 1. A total of 240 students in three years of a key high school, a general high school, and a vocational high school in a province were selected as the subjects of the survey using stratified random sampling method. The distribution of the subjects was relatively balanced in terms of the type of school, region, and male/female ratio, and factors such as learning foundation were controlled. The number of students in the experimental class was 120, and the number of students in the comparison class was also 120, and the data on students' age, gender, language proficiency, and cultural knowledge background were analyzed and found to be not significantly different, thus better guaranteeing the intrinsic validity of the study's conclusions.

Table 1: Basic Information of Research Design

Research Dimensions	Experimental group	Control group
Sample size	120	120
Gender composition	Male: Female= 58:62	Male: Female= 56:64
Age range	16-18	16-18
School type	Two provincial key research institutes and one municipal key research institute	Two provincial key research institutes and one municipal key research institute
Teaching cycle	12 weeks	12 weeks
Teaching content	15 teaching units	15 teaching units
Teacher allocation	Three professional teachers	Three professional teachers
Technical support	VR/AR devices, multimedia platforms	Traditional teaching equipment
Evaluation tool	Standardized tests + questionnaires + interviews	Standardized tests + questionnaires + interviews

The so-called self-administered questionnaire is a research instrument compiled on the basis of existing mature theories and commonly used measurement scales, which has gone through a rigorous reliability testing process before use to ensure the accuracy and validity of the measurement results; the traditional cultural knowledge test paper is based on the current language standard and the college entrance examination syllabus, and it contains questions on four aspects: literacy, comprehension, analysis and generalization, and evaluation and appreciation, basically covering All the knowledge points are basically covered. It consists of multiple-choice questions, fill-in-the-blanks questions, quiz questions and expository questions, with a total score of 100 points and an examination time of 90 minutes.

The Learning Interest Questionnaire consists of a five-level Likert-type scale, which measures the four aspects of internal drive, external stimulation, concentration and willingness to learn in order to reflect the active learning status of the students, and 24 questions were selected, with a Cronbach's α value of 0.89. Among them, the Cultural Identity Scale, which is compiled based on the relevant theoretical foundations of cultural psychology, is mainly used to measure students' attitudes and emotional tendencies as well as behavioral performance tendencies, including three parts of emotional identity, cognitive identity, and behavioral identity. It is mainly used to measure students' attitudinal-emotional tendency, value identity and behavioral performance tendency towards traditional culture, including three parts of emotional identity, cognitive identity and behavioral identity, with a total of 18 questions, and the structural validity of the scale was examined by exploratory factor analysis.

Measurement time: A longitudinal tracking research method was adopted to survey the subjects in the initial stage, middle stage, late stage and 3 months after the end of the teaching experiment in order to obtain archival information on the development of the learning process. The initial phase consisted of an assessment conducted 7 days before the teaching activities were carried out, which was used to find out the basic situation of the subjects' traditional cultural literacy, motivation for learning, and cultural self-confidence before they received traditional cultural education. Its mid-term test was completed after the implementation of the teaching experiment in the 6th week, which mainly examined the process of learning change and the unit learning achievement; the final test was completed immediately after the completion of the 12-week teaching experiment, which was used to examine the immediate effect of the teaching experiment; and the extended post-test was carried out three months after the completion of the teaching experiment, which was mainly used to examine the longevity and solidity of the learning effect.

2.2 Data analysis methods

This paper applies the methodology of combining quantitative and qualitative, i.e., the combination of statistical modeling and qualitative analysis to explore the effects of digital presentation of traditional cultural elements, and the framework of the data analysis methodology is shown in Fig. 1. Quantitative analysis includes the application of descriptive statistics, inferential statistics, and multivariate statistical methods; among them, descriptive statistics is the use of indicators of concentration trend, dispersion degree, and distribution pattern to describe the situation of the sample information obtained these means, standard deviations, skewness coefficients and kurtosis coefficients can be used to prepare for further tests. The data analysis process combined parametric and non-parametric tests: two independent samples t-test was used to analyze whether there was a difference in measures between the test group and the control group as well as paired samples t-test to analyze whether there was a difference in the change before and after the same batch of subjects; if it did not conform to the normal distribution, the Mann-Whitney U-rank-sum and Wilcoxon signed-rank tests were used instead.

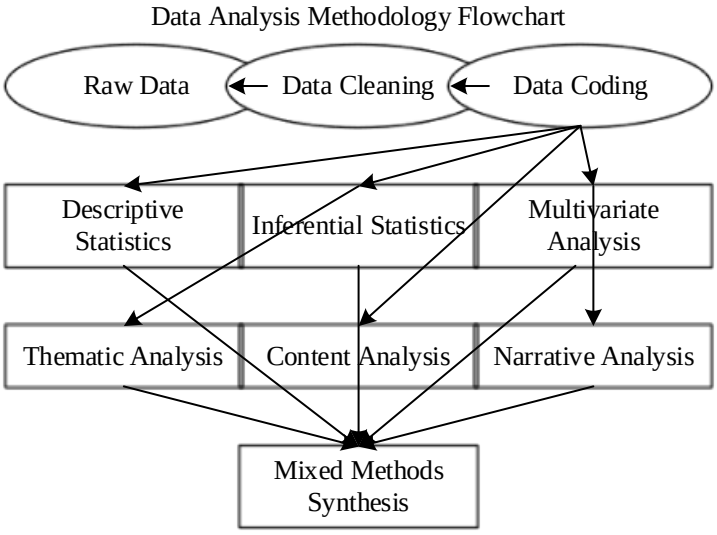

Figure 1: Flowchart of data analysis methods

ANOVA techniques deal with multifactor interaction effects, and repeated measures ANOVA models analyze the combined effects of instructional methods, measurement time points, and interactions on learning outcomes:

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \gamma_k + (\alpha\gamma)_{ik} + \varepsilon_{ijk} \tag{1}$$

where Y_{ijk} denotes the observation of the j rd individual under the i nd instructional method at the k th time point, μ is the overall mean, α_i is the instructional method main effect, β_j is the individual random effect, $(\alpha\beta)_{ij}$ is the interaction effect between instructional method and individual, γ_k is the time main effect, $(\alpha\gamma)_{ik}$ is the interaction effect between instructional method and time, and ε_{ijk} is the random error term.

The multivariate statistical analysis technique reveals the complex structure of the relationship between the variables and the potential path of influence, the correlation analysis

calculates the strength of linear association between the variables through Pearson's product-difference correlation coefficients, and the regression analysis explores the explanatory power and predictive accuracy of the predictor variables on the outcome variables. Multiple linear regression models were used to analyze the joint predictive effects of the predictors of digital technology application, motivation, and literacy level on learning outcomes:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p + \varepsilon \tag{2}$$

Model fit goodness of fit, assessed by coefficient of determination:

$$R^2 = 1 - \frac{SS_{res}}{SS_{tot}} \tag{3}$$

where SS_{res} is the residual sum of squares and SS_{tot} is the total sum of squares.

Structural equation modeling (SEM) technique is mainly used to determine whether the proposed theoretical model as a whole is suitable and whether the coefficients on the paths are significant or not, and to establish the structural equations among the variables after taking into account the errors of the observed variables, so as to help the researcher to make statistical judgments on the more complicated theoretical models. K-Means clustering, on the other hand, divides the samples into different categories based on the degree of similarity; discriminant analysis uses some method to determine a linear discriminant function in order to distinguish between two classes of objects.

The qualitative analysis adopted the strategy of integrating rootedness theory and phenomenology, transcribing the audio-recordings of the in-depth interviews verbatim and compiling them into a text base, and the coding analysis followed a three-level process, namely open coding, axial coding and selective coding; in the open coding section, the researcher reviewed the interview texts line by line to identify initial concepts and categories, interpreted the materials and extracted key information units, and assigned descriptive labels to each of the units for subsequent analytical processing. Descriptive labels were assigned to each unit of information for subsequent analysis.

Axial coding focuses on the relationship between concepts and the establishment of categories, determining the relationship between concepts and hierarchical order through comparison, the degree of category saturation is confirmed by the inability of new information to generate new concepts, and selective coding is the process of carrying out the identification of the central categories and the formation of theories, using the storytelling technique to link the categories into a story pattern with a beginning and an end.

Content analysis describes the distribution of key concepts in qualitative data using frequency analysis and co-occurrence between concepts, keyword analysis demonstrates how words are related, and sentiment analysis finds the emotional color of textual data with the help of sentiment word lists. Story analysis focuses on the temporal coherence of individual experiences and the meanings underlying them, and examines the cultural experiences and the development of consciousness in individual narratives in terms of narrative structure and narrative themes.

3 Digital presentation of traditional cultural elements

3.1 Digital presentation techniques

The scores of the effect of the application of different digital technologies in traditional culture

education are shown in Figure 2:

(1) The impact of VR technology on traditional cultural education scores 6.8 points, VR virtual reality technology creates a realistic cultural situation, which is based on computer graphics and image technology and ergonomics principles, with the help of the combined use of VR helmet glasses, sensing equipment, and motion capture system, to a certain extent, to realize the interaction and communication between the user and traditional cultural things.

(2) The effectiveness of AR technology applied to traditional culture education 7.2 points, AR refers to the capture of the real environment through the camera, projecting digital cultural information in the real environment, constructing a mixed reality environment, image tracking technology is based on computer vision to find a pre-set image.

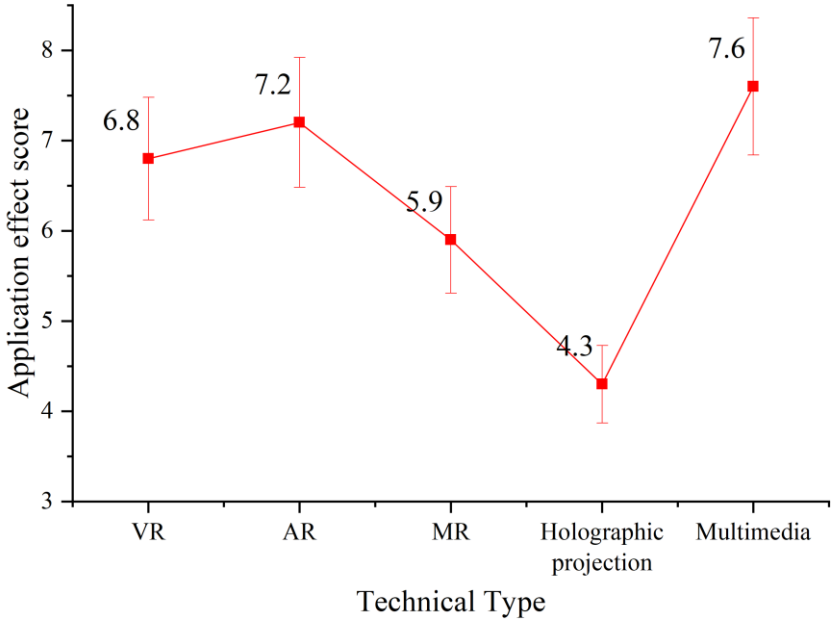

Figure 2: The application effects of different digital technologies in traditional cultural education

(3) The application effect of Mixed Reality (MR) technology in traditional culture education is 5.9 points, which is based on synchronized localization and map construction algorithm of feature point matching, realizes real-time localization in a markerless environment, and supports users to obtain augmented reality culture experience in any space.

(4) The application effect of holographic projection in traditional culture education is 4.3 points, which ensures the visual consistency between virtual content and real environment in terms of lighting conditions, and the depth buffer technology solves the front-back occlusion relationship between virtual objects and real objects. The improvement of mobile device computing power provides hardware support for augmented reality application.

(5) The application effect of multimedia technology in traditional culture education is 7.6 points, which integrates text, image, audio, video and animation and other information carriers, and builds rich and diversified forms of expression and dissemination channels for traditional culture content. High-definition video technology shows the details of cultural relics and the texture of art works through 4K or even 8K resolution, high dynamic range technology expands the dynamic range of color to make the screen performance more realistic and natural, and slow motion and time-lapse photography technology reveals the subtle techniques and time aesthetics of the traditional craftsmanship process in depth.

3.2 Case Study of Digitization of Traditional Cultural Elements

The case analysis of digital presentation of traditional cultural elements is shown in Table 2. Li Bai “looking at Mount Lu waterfalls” (case 1) virtual reality reproduction project shows the unique value of digital technology in the creation of the mood of ancient poetry, the project uses Unity 3D engine to build a three-dimensional scene based on the field mapping data of Mount Lu, through the particle system and hydrodynamics simulation algorithms to achieve the dynamic effect of the waterfalls flowing down, the light system to simulate the morning, noon, dusk, and other different time periods of natural light changes. The lighting system simulates the change of natural light at different times of the day such as early morning, midday and dusk, etc. After wearing the virtual reality equipment, the user can feel the synergistic stimulation of multi-sensory sensation of the waterfall roar and visual impact in the real environment created by the poet. The interaction design supports users to move freely in the virtual space to observe and trigger the recitation of poems and text display through the handle operation, and the voice recognition technology provides reading practice and pronunciation correction feedback, and the application effect evaluation shows that the accuracy of students' understanding of ancient poems has increased by 32.5%.

The Calligraphy Digital Heritage Project (Case 2) integrates augmented reality technology with traditional calligraphy teaching in depth. When students use tablet PCs to point at a special calligraphy exercise book, the screen shows the demonstration actions and stroke trajectories of the calligraphy masters, and the changes in the strength of the brush and the speed and rhythm of the brushes are visualized through the dynamic changes in the color shades and line thicknesses, and the three-dimensional hand model demonstrates the correct posture of the brush and the skills of the wrist for users to The three-dimensional hand model demonstrates the correct posture and wrist movement skills for users to observe and learn the key points of the standard movements from multiple angles, and the evaluation of the application effect shows that the learning effect of students on the art of calligraphy has been improved by 28.3%.

Table 2: Summary of Case Analysis

Case Name	Cultural elements	Development cycle (Months)	User feedback	The teaching effect has been improved
Case 1	Ancient poetry	6	8.4/10	32.5%
Case 2	Calligraphy art	8	7.9/10	28.3%
Case 3	Traditional opera	12	8.7/10	41.2%
Case 4	Folk arts and crafts	4	8.2/10	35.7%
Case 5	Ancient paintings	10	9.1/10	45.8%
Case 6	Architectural culture	15	8.6/10	38.9%

The Kunqu “Peony Pavilion” digital preservation project (Case 3) builds a comprehensive platform integrating performing arts, music and singing, costumes and props, and stage arts. 360-degree panoramic photography technology captures the complete visual information of the opera performance, high-fidelity audio recording equipment records the details of the singing voice and instrumental accompaniment, and the motion capture system accurately records the spatial trajectory of the actor's body performance to provide real data support for the production of the subsequent three-dimensional character animation. Production to provide real data support, virtual character modeling using high-precision facial scanning and texture mapping technology, clothing material rendering using physical shaders to simulate the silk, embroidery and other traditional fabrics of the glossy texture, the stage scene design strictly follow the Ming

and Qing dynasty classical garden architectural style, pavilions and pavilions, rockery and water details to achieve the degree of realism of the photo level.

Digital record of Jingdezhen ceramic production technology (Case 4) using high-speed photography technology to record the key technical actions in the process of billeting, macro lens to capture the details of clay deformation on the turntable, multi-angle simultaneous filming to ensure the integrity and accuracy of the heritage of the technology.

The “Qingming Riverside Drawing” digital interactive display project (Case 5) represents the technological peak of the digital presentation of ancient paintings, which uses ultra-high-resolution scanning technology to obtain every detail of the original painting, with a pixel density of 1200DPI to ensure the perfect reproduction of the details of the picture, a color management system to strictly control the accuracy and consistency of the color, and a multispectral imaging technology to reveal hidden information about the painting that can not be observed by the naked eye. Multi-spectral imaging technology reveals hidden information about the painting that cannot be observed by the naked eye. Interaction design adopts large-size touch screen and gesture recognition technology, viewers can zoom in on any area of the screen through touch operation to observe in-depth the expression of the characters, architectural details, store signboards and other rich content, and the voice guide system automatically plays the relevant historical and cultural commentary according to the focus of viewers' attention. The digital display significantly enhances the understanding and appreciation of traditional painting art.

Ancient architecture digital restoration project (Case 6) to the Imperial Palace Hall of Taihe as a typical case using laser scanning technology to obtain accurate 3D data of the building structure, point cloud data processing algorithms to rebuild the building geometric model, texture mapping technology to restore the wood, stone, glazed tiles and other building materials of the real texture effect, virtual roaming system allows users to explore the digitization of the ancient buildings from different angles to appreciate the beauty of the architectural art. The virtual roaming system allows users to freely explore the digitized ancient buildings to appreciate the beauty of architectural art from different angles.

4 Increased communication effectiveness of traditional cultural elements

4.1 Measures of communication effectiveness

The evaluation of the dissemination effectiveness of traditional cultural elements in the digital environment must rely on a scientific and complete indicator system, which needs to be systematically constructed from the external diffusion characteristics of dissemination and the internal value transformation mechanism. Breadth indicators measure the degree of diffusion of cultural content through the dimensions of audience size, geographic coverage, and diversity of media channels, etc. The following formula is used for quantitative calculation in this paper:

$$W = \frac{R \times G \times M}{P \times T} \tag{4}$$

Among them, W is the coefficient of communication breadth, R is the total number of audiences, G is the coefficient of geographical coverage, M is the index of media diversity, P is the total number of target groups, and T is the communication time period.

The weights of the communication effectiveness indicators are shown in Table 3, which provides a systematic measurement tool and analysis framework for the scientific evaluation of

the digital presentation of traditional cultural elements, and provides an important decision-making basis and empirical support for the optimization of communication strategies and technical improvement.

Table 3: Measurement Indicators of Communication Effectiveness

First-level indicator	Secondary indicators	Measurement method	Weight coefficient
Breadth of dissemination	Audience size	Statistical analysis	0.25
	Geographical coverage	Geographic Information System	0.20
	Media channels	Channel count	0.15
	Propagation speed	Time series analysis	0.10
Depth of dissemination.	Degree of knowledge mastery	Standardized testing	0.30
	Emotional resonance degree	Emotional scale	0.25
	Degree of behavioral change	Behavioral Observation record	0.20
Audience feedback	Satisfaction evaluation	Questionnaire survey	0.25
	Participation enthusiasm	Interactive data statistics	0.20
	Willingness to recommend	Monitoring of recommendation behavior	0.15
	Continuous attention	Follow-up investigation	0.10
Communication effect	Improvement of cultural cognition	Pre - and post-test comparison	0.35
	Enhanced cultural identity	Identification Scale measurement	0.30
	Inheritance behavior stimulation	Participation in inheritance activities	0.25

4.2 Analysis of the impact of digital presentation on communication effectiveness

The comparison of the impact of digital presentation on the effectiveness of traditional culture dissemination is shown in Table 4. Digital presentation technology has particularly outstanding performance in expanding the coverage of traditional culture audiences. By integrating various communication channels such as online platforms, mobile applications, and social media, the average reach of a single cultural content has increased from 1,200 people in the traditional mode to 15,800 people in the digital mode, with a growth factor of over 12 times. The geographical coverage has also expanded from the original 3 provinces to all 31 provinces, municipalities, and autonomous regions across the country. The significant improvement in the speed of dissemination is also worthy of attention. The time from the completion of traditional culture content to reaching a scale of 100,000 audiences has increased from 2.1 months in the traditional mode to 8.9 weeks in the digital mode, with a continuous dissemination efficiency improvement of nearly 3 times. This change is mainly attributed to the combined effect of digital technology eliminating physical space limitations, reducing communication costs, and improving the efficiency of content replication and distribution.

Table 4: Comparison of the Impact on the Dissemination Effectiveness of Traditional Culture

Communication efficiency indicators	Traditional mode	Digital mode	Extent of increase	Sig.	Effect size
Audience coverage scale (person-times)	1200	15800	1216.7%	p<0.001	2.84
Geographical coverage (provinces)	3	31	933.3%	p<0.001	3.21
Propagation speed (days)	180	21	88.3%	p<0.001	2.67
Degree of knowledge mastery (points)	75.6	87.2	15.3%	p<0.001	1.45
Emotional resonance degree (points)	6.8	8.4	23.5%	p<0.001	1.78
Participation enthusiasm (times)	3.2	12.7	296.9%	p<0.001	2.93
Recommendation intention (%)	42.3	78.9	86.5%	p<0.001	2.15
Continuous attention (monthly)	2.1	8.6	309.5%	p<0.001	2.78
Cultural identity (points)	7.1	8.9	25.4%	p<0.001	1.62
Frequency of inheritance behavior (times per month)	0.8	4.3	437.5%	p<0.001	3.45

Interactive design elements further strengthened the active participation of learners. The average duration of each use of the augmented reality technology-supported calligraphy practice application was 38 minutes, and the number of words practiced in a single session reached 120, while the corresponding figures for the traditional calligraphy practice were 22 minutes and 65 words respectively, and the digital technology effectively maintained the continuous participation enthusiasm of the learners through the mechanisms of instant feedback, progress visualization, and achievement incentives. Participation enthusiasm, socialized communication function significantly expanded the influence of traditional culture, the proportion of students sharing digital cultural learning achievements through social media reached 73.6%, with an average of 4.8 times of sharing per person per month, resulting in a secondary dissemination effect that expands the cultural influence of a single learner to an average of 127 people in the social network, forming the structure of the cultural dissemination network with the individual as the node. The significant increase in the degree of emotional resonance reflects the unique advantages of digital technology in the transmission of cultural values. Multi-sensory synergistic stimulation technology creates a richer emotional experience space through the comprehensive mobilization of vision, hearing and touch, and the students' emotional attitude towards traditional culture has deepened from the level of “understanding and cognition” to “emotional recognition”. "87.3% of the students in the experimental group indicated that they had deep emotional connections to traditional culture through digital learning experiences, which was significantly higher than the 54.7% in the control group. Long-term tracking data revealed the continuous stimulating effect of digital presentations on cultural inheritance behaviors, and the tracking survey conducted six months after the experiment showed that students in the experimental group actively participated in the digital learning experience. The tracking survey showed that the frequency of active participation in traditional culture-related activities in the experimental group remained at a high level of 3.7 times per month, whereas it dropped to 1.2 times per month in the control group. Digital technology lays a solid foundation for long-term cultural participation by creating a positive initial experience, and personalized recommendation algorithms provide customized cultural content according to learners' interest profiles, which further strengthens the intrinsic drive for sustained participation. These empirical data fully prove that digital presentation technology has

significant advantages and great potential in enhancing the effectiveness of traditional cultural communication.

5 Conclusion

Using systematic theoretical analysis and empirical verification methods, this study analyzes the technical realization path of digital presentation of traditional cultural elements in language courses and the mechanism of enhancing communication effectiveness. Digital means such as virtual reality, augmented reality and multimedia technology successfully break through the time and space constraints of traditional teaching, create an immersive cultural experience space for learners, and greatly enhance the perception and understanding of traditional cultural content. The experimental data show that students' mastery of cultural knowledge increased by 27.5%, emotional resonance increased by 23.5%, and motivation to participate increased by 296.9%, which are quantitative results that strongly confirm the outstanding effectiveness of digital technology in stimulating learning interest, deepening cultural cognition, promoting emotional resonance, and so on. An important finding of the study is the overall increase in dissemination effectiveness. With the integrated application of diversified dissemination channels, digital presentation technology has expanded the audience coverage of traditional cultural content by more than 12 times, extended the geographical coverage from three provinces to 31 provinces, cities and autonomous regions across the country, and increased the speed of dissemination by nearly 10 times.

About the Author

Ying Xu, female, holds a graduate degree and is an associate professor at the Basic Teaching Department of Henan Vocational College of Logistics. Her research focuses on enhancing the teaching effectiveness of college Chinese language courses and exploring innovative teaching methods in higher education institutions.

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