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Article

Red Culture Enabling Civic and Political Education in Colleges and Universities in a Digitalized Environment: Exploring the Path of Benefit Enhancement under the Perspective of Enterprise Operation

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Abstract: This study is based on the digital environment and explores ways to enhance the effectiveness of red culture in college ideological and political education from the perspective of corporate operational efficiency. A three-dimensional framework for integrating red culture into higher education ideological and political education in the era of integrated media has been systematically constructed. To uncover the intrinsic mechanisms of red culture dissemination, this study proposes a research hypothesis based on communication theory: media interest (PB) and media perception frequency (QD) positively influence cognition (BU) and attitude (XW), which ultimately impact cultural identity (ID). A questionnaire incorporating these five dimensions was developed accordingly. Structural equation modeling (SEM) was employed for empirical validation. Based on empirical findings and corporate operational logic, the study proposes four pathways for enhancing benefits in the integration of core values, mutual learning of management methods, collaborative practice, and co-construction of campus culture between ideological and political education and corporate culture. Descriptive statistics show that students have high levels of cognition (e.g., BU3 = 4.51) and identity (e.g., ID2 = 4.22) toward red culture, but there are differences in media perception frequency, particularly in meeting channels (QD4 = 2.74), which are significantly lower. Confirmatory factor analysis (KMO = 0.876, Bartlett's test $p < 0.001$) and composite reliability (CR > 0.7) and average variance extracted (AVE > 0.5) confirm the scale's good validity. After model correction (removing the insignificant QD4 path) in SEM analysis, the model fit was ideal (CMIN/DF = 1.347, RMSEA = 0.035, GFI > 0.9). The study indicates that course instruction (PB3) and campus activities (QD5) are the core communication channels.

Keywords: red culture dissemination; ideological and political education in higher education; structural equation modeling; corporate culture integration

1. Introduction

In recent years, with the development of education powerhouses and the iterative updates of digital technology, educational and teaching practices based on digital technology have also entered a fast track of high-quality development [1]. Red cultural resources are valuable resources for ideological and political courses in colleges and universities to conduct education on firm ideals and beliefs [2]. Using cutting-edge digital technology to empower the practical teaching of ideological and political courses in colleges and universities with red cultural resources is of positive significance for exploring innovative paths for educational digitization.

In light of this, academic circles have conducted many beneficial explorations into teaching methods for ideological and political theory courses in higher education institutions in recent years [3]. For

example, Su, L and Li, M explored the application of immersive digital technology in enhancing the teaching effectiveness of ideological and political theory courses in higher education institutions, emphasizing its advantages in enhancing emotional experiences, restoring attention, and providing interactive learning environments [4]. Wang, X explored the transformation of online education for ideological and political theory courses in the era of big data and proposed solutions such as establishing an online education big data system, and the formulation of data management regulations [5]. Song, B, and Qiu, R combined augmented reality technology with deep learning, finding that digital virtual technology overcomes the limitations of traditional teaching methods and significantly improves the educational effectiveness of ideological and political education in higher education [6]. Yue, S, et al. constructed a self-assessment learning system using digital technology, which achieved good results when applied to ideological and political education for college students, and utilized internet multimedia and digital virtual technology to enhance educational outcomes and social practice capabilities [7]. Xia, Z, and Liu, J integrated wireless communication and artificial intelligence technology into college ideological and political courses, finding that this approach improved learning efficiency. Based on questionnaire surveys and teaching experiment results, they proposed innovative reform suggestions [8]. He, X, et al. proposed an integrated online teaching model combining educational psychology with deep learning, aiming to enhance the efficiency of ideological and political education in Chinese universities. Research findings indicate that student engagement, values, ideology, moral concepts, and knowledge reserves all improved under this model [9]. Yang, H developed an intelligent teaching method for ideological and political education in higher education institutions from an innovation and entrepreneurship perspective. By effectively integrating big data analysis technology and IoT sensor technology, a stable system was formed, thereby enhancing the efficiency of ideological and political education [10]. Most of these studies focus on the digital transformation of teaching methods, with limited exploration of specific pathways for integrating red cultural resources with digital technology [11]. Therefore, utilizing digital technology to explore the value implications and integration pathways of red cultural resources in empowering ideological and political education courses in higher education institutions is an urgent area of focus [12].

This study first systematically explores the specific implementation pathways for deeply integrating red culture into higher education ideological and political education in the context of the integrated media era. Second, to scientifically validate the intrinsic mechanisms and effects of red culture dissemination, a research framework centered on structural equation modeling (SEM) was constructed. Based on communication theory and relevant literature, theoretical hypotheses (H1-H3) were proposed regarding the relationships among red culture dissemination media, cognition, attitude, and identity. Accordingly, a rigorous scale was designed to explore these relationships across five dimensions: interest in red culture dissemination media, perceived frequency of red culture dissemination media, red culture cognition, attitude toward red culture dissemination, and red culture identity. Data collection was then conducted. Finally, the principles, components, and application logic of structural equation modeling in this study were detailed, aiming to reveal the complex influence pathways among variables through quantitative analysis. SEM is a powerful multivariate statistical technique capable of simultaneously handling multiple observed variables and latent variables, analyzing complex influence relationships among variables, accommodating measurement errors, and providing indicators for assessing the overall model fit. The model consists of a measurement model and a structural model. The measurement model describes how latent variables are measured by their corresponding observed variables. Latent variables are connected to observed variables through factor loading matrices, which include measurement error terms. The structural model describes the causal relationships among latent variables. Path coefficients matrices are used to represent the effects of endogenous latent variables on each other and the effects of exogenous latent variables on endogenous latent variables.

2. Research on the Dissemination of Red Culture Based on Structural Equation Modeling

2.1. Pathways for Red Culture in Ideological and Political Education in Higher Education Institutions in the Era of Converged Media

In the era of integrated media, the dissemination of red culture in higher education ideological and political education should be guided by the value orientation of integrated media digital empowerment, achieving efficient integration of red culture in classroom teaching, environmental creation, and social practice, thereby maximizing the effectiveness of integrated communication.

First, achieve the integration of “digitalization + red culture” in classroom teaching. The course design and content development of ideological and political education in higher education institutions should make full use of existing integrated media forms such as digital classrooms, online classrooms,

and multimedia classrooms, and further integrate technologies such as virtual reality, human-computer interaction, and instant communication. Diversified audio-visual teaching resources should be developed in a coordinated manner around the objectives of ideological and political education. At the same time, immersive experiential teaching courses should be developed. Through real-time interaction via PC terminals, multimedia panels, and mobile apps for young students, vibrant red scenes should be recreated in ideological and political education courses, creating an immersive red cultural space for students.

Second, build a “digitalization + red culture” campus environment. Within the existing campus environment, we should leverage centralized exhibition spaces such as the university history museum to deeply distill regional red culture and red university history, forming a red cultural environment characterized by “core elements integrated throughout.” For example, we should establish “digital ideological and political education media learning stations” in buildings, halls, museums, and other facilities, creating landscape zones that integrate “red culture presentation,” “digital structures of red spirit,” and “recreation of red symbols within the campus.” Additionally, the symbolic value of red culture should be fully utilized. Within the core planning of universities, a landscape axis for red culture should be clearly defined to create red landmarks with greater aesthetic appeal and emotional impact.

Third, achieve the integration of “digitalization + red culture” into social practice. President Xi Jinping emphasized: "For a value system to truly take effect, it must be integrated into social life, allowing people to perceive and understand it through practice. We must pay attention to closely linking what we advocate with people's daily lives, and focus on implementing it in detail, on a small scale, and effectively.“ Regarding social practice as a goal-oriented component of education, we should explore pathways for integrating red culture through digital tools. Through practical forms such as the ”Red Culture I Perform“ program by the Red Culture Lecturer Team and the ”Internet Red Culture Creative Competition," we should implement the dissemination of red culture in the practical activities of young students.

2.2 Research on the Dissemination of Red Culture in Universities

After exploring the specific practical pathways for integrating red culture into higher education ideological and political education in the era of integrated media, to gain a deeper understanding of the intrinsic mechanisms and effectiveness of red culture dissemination in higher education institutions, it is necessary to shift focus to theoretical analysis and empirical testing of the dissemination process itself. Therefore, this section defines the concept of “red culture dissemination in higher education institutions,” clarifying its key elements—including its subjects, audience, content, objectives, and the pivotal role of communication media—and based on this, proposes a core research hypothesis aimed at revealing the relationships between media interest, cognition, attitude, and identification.

2.2.1. Dissemination of Red Culture in Universities

The dissemination of red culture in higher education institutions specifically refers to a series of activities organized and led by professional teaching teams and relevant functional departments within the scope of higher education institutions. These activities are carefully planned with college students as the core audience and active participants, aiming to promote and disseminate red culture. Such dissemination activities not only constitute an important component of higher education institutions' implementation of the “moral education and talent cultivation” educational philosophy but also specifically target college students as the audience. In terms of content construction, higher education institutions fully leverage the red historical resources of their regional locations and the red elements within their institutional history and culture to create dissemination content closely linked to red history and red spirit, featuring a unique personality. Through such red culture dissemination activities, higher education institutions aim to guide college students in deeply understanding and inheriting red traditions while cultivating their socialist core values. In these dissemination activities, media plays a crucial role as the bridge and carrier of information transmission. For content dissemination, media is an indispensable component that determines the breadth and depth of information transmission.

H1: There is a positive relationship between interest in red culture dissemination media and red culture identity.

Hla: Red culture cognition mediates the relationship between interest in red culture dissemination media and red culture identity.

H1b: Red culture attitude mediates the relationship between interest in red culture communication media and red culture identity.

H2: There is a positive relationship between interest in red culture communication media and red culture cognition.

H3: There is a positive relationship between interest in red culture communication media and red culture communication attitude.

2.2.2. Questionnaire Design

Based on relevant literature, the questionnaire consists of five dimensions: interest in red culture communication media, perceived frequency of red culture communication media, red culture cognition, attitude toward red culture communication, and red culture identity. The indicators for each dimension of red culture communication in colleges and universities are shown in Table 1.

Table 1. Dimensional indicators of the dissemination of red culture in colleges.

Dimension	Item	
Interest degree in red culture dissemination media	The degree of interest in the channels for the dissemination of red culture below the school	PB1:Network dissemination
		PB2:Campus radio, school newspapers and periodicals
		PB3:Course teaching
		PB4:Meeting
		PB5:All kinds of cultural activities
The perceived frequency of red culture dissemination media	The frequency of your perception of red culture through the following communication channels at school	QD1:Network dissemination
		QD2:Campus radio, school newspapers and periodicals
		QD3:Course teaching
		QD4:Meeting
		QD5:All kinds of cultural activities
Cognition of red culture	BU1: Do you have any knowledge about red culture	
	BU2; How well do you know about the red culture in Xinjiang	
	BU3: Do you know about the history of the Communist Party of China leading the Chinese people in revolution, construction and reform	
Identification with red culture	ID1: Do you think it is important to inherit and carry forward the spiritual qualities and fine traditions of the revolutionary predecessors in the new era	
	ID2: After visiting red scenic spots, participating in red-themed activities and learning about red culture, how did you feel about it	
	ID3: Do you think learning about red culture is helpful for personal	

	growth
Attitudes towards the dissemination of red culture	XW1: How much do you support the dissemination of red culture in schools
	XW2: How interested are you in the dissemination of red culture in schools
	XW3: What's your opinion on participating in red culture dissemination activities at school

Quantitative assessments of various dimensions related to college students' interest in red culture dissemination media, perceived frequency of red culture dissemination media, red culture cognition, and attitudes toward red culture dissemination were all conducted using a five-point Likert scale, with scores ranging from 1 to 5 representing “completely unaware,” “not very aware,” “somewhat aware,” “fairly aware,” and “very aware,” respectively, in ascending order of depth. The quantitative assessment of the dimension of identification with red culture also employs a five-point Likert scale, with 1–5 representing “very high,” “moderately high,” “average,” “almost none,” and “completely none,” respectively, to accurately reflect students' levels of identification.

2.3. Structural Equation Model

This study adopts the structural equation model (SEM), a powerful multivariate statistical technique. SEM is a multivariate data analysis method that can simultaneously study the relationships between multiple measured variables and latent variables, as well as their effects on outcomes. It allows for measurement errors and accurately calculates the fit indices of measured variables and latent variables, while also providing technical means to adjust these fit indices. Given the complex relationships involved in quantifying ideological and political education in higher education institutions under the influence of red culture, SEM was selected as the analytical method for this study.
Structural equation model matrix equations:

$$x = \Lambda_x \xi + \delta \tag{1}$$

$$y = \Lambda_y \eta + \varepsilon \tag{2}$$

$$\eta = B\eta + \Gamma\xi + \zeta \tag{3}$$

Formulas (1) and (2) are measurement model equations, and formula (3) is a structural model equation.

where x is the exogenous measurement vector, Λ_x is the factor loading matrix of exogenous variables on exogenous latent variables, and δ is the residual vector of exogenous observed variables; y is the endogenous measurement vector, Λ_y is the factor loading matrix of endogenous variables on endogenous latent variables, and ε is the residual vector of endogenous observed variables;

B and Γ are path coefficients, where B represents the relationship between endogenous latent variables, Γ represents the relationship between exogenous latent variables, and ζ is the error term of the structural equation.

Measurement model: Represents the relationship between latent variables and measured variables, with the equation being:

$$x_1 = \lambda_{x11}\xi_1 + \sigma_1 \tag{4}$$

$$y_1 = \lambda_{y11}\eta_1 + \varepsilon_1 \tag{5}$$

Among them:

$$x=\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}\quad \Lambda_x=\begin{bmatrix}\lambda_{x11}\\\lambda_{x21}\\\lambda_{x31}\end{bmatrix}\quad \xi=[\xi_1]\quad \sigma=\begin{bmatrix}\delta_1\\\delta_2\\\delta_3\end{bmatrix}$$

$$y=\begin{bmatrix}y_1\\y_2\\y_3\end{bmatrix}\quad \Lambda_y=\begin{bmatrix}\lambda_{y11}&0\\\lambda_{y21}&0\\\lambda_{y31}&0\\0&\lambda_{42}\\0&\lambda_{52}\\0&\lambda_{62}\end{bmatrix}\eta=\begin{bmatrix}\eta_1\\\eta_2\end{bmatrix}\varepsilon=\begin{bmatrix}\varepsilon_1\\\varepsilon_2\\\varepsilon_3\\\varepsilon_4\\\varepsilon_5\\\varepsilon_6\end{bmatrix} \tag{6}$$

Structural model: Represents the causal relationships between latent variables, with the equation being:

$$\eta_1=\gamma_{11}\xi_1+\zeta_1 \tag{7}$$

$$\eta_2=\beta_{21}\eta_1+\gamma_{21}\xi_1+\zeta_2 \tag{8}$$

$$B=\begin{bmatrix}0&0\\\beta_{21}&0\end{bmatrix}\quad \Gamma=\begin{bmatrix}\gamma_{y11}\\\gamma_{y21}\end{bmatrix}\quad \zeta=[\zeta_1] \tag{9}$$

Structural equation modeling (SEM) places high demands on data quality, including sample size, measurement relationships, and causal relationships. If data quality does not meet the required standards, it can lead to poor model fit, resulting in unsatisfactory fitting metrics. Regarding sample size, generally, a sample size of five times the number of measurement variables is required. If the fitting quality is poor, a sample size of 10–15 times or at least 220 samples is needed. Regarding the quality of measurement relationships and influence relationships, exploratory factor analysis, confirmatory factor analysis, and path analysis are typically conducted prior to the analysis to ensure the fitting quality of the subsequent structural equation model. The fitting quality and related metrics of the structural equation model are derived by comparing the covariance matrix of the predicted relationships with that of the fitted relationships. There are numerous fit indicators for structural equation models, and academic circles have differing opinions on the requirements for these indicators. Commonly used indicators include the chi-square-to-degrees-of-freedom ratio (χ^2/df), GFI, RMSEA, RMR, CFI, NFI, and NNFI. It is very difficult for all fit indicators to meet the standards; adjusting the fit indicators to an acceptable range based on research requirements is sufficient.

3. Empirical Analysis of the Dissemination of Red Culture in Universities Based on Structural Equation Modeling

Based on the theoretical framework and research hypotheses established in Chapter 2, as well as the five-dimensional measurement scale (media interest, perceived frequency, cognition, attitude, and identification) designed, this study enters the empirical testing phase. Chapter 3 aims to use structural equation modeling (SEM) to conduct quantitative analysis of the collected sample data to verify the internal mechanisms and efficacy pathways of red culture dissemination.

3.1. Sample Data Processing

Taking students from a certain university as the research subjects, this study explores the role of red culture in empowering ideological and political education in higher education from the perspective of corporate operations. A total of 524 students from various grades and majors were randomly selected, and a survey questionnaire on the dissemination of red culture in higher education was distributed. A total of 500 questionnaires were actually returned, with an effective rate of 95.42%.

3.1.1. Descriptive Statistical Analysis

First, descriptive statistical methods were used to analyze the 500 sets of samples obtained. At the same time, it was necessary to verify whether the samples met the normal distribution. The descriptive

statistical results of the dissemination of red culture are shown in Table 2 below.

Table 2. Descriptive statistical results of the dissemination of red culture.

	Average value	Median	Skewness	Kurtosis	Minimum value	Maximum value
PB1	3.50	4	-1.354	2.501	0	5
PB2	3.21	3	0.102	2.876	0	5
PB3	4.13	4	-0.875	4.210	1	5
PB4	2.88	3	2.245	7.345	0	5
PB5	3.79	4	-0.567	3.012	0	5
QD1	3.46	4	-2.432	12.789	0	5
QD2	2.99	3	3.123	6.456	0	5
QD3	4.21	4	-1.023	5.678	1	5
QD4	3.00	3	0.056	2.123	0	5
QD5	3.45	4	-0.345	2.892	0	5
BU1	3.88	4	-0.789	3.456	0	5
BU2	3.57	4	-0.456	2.789	1	5
BU3	4.32	5	-1.234	4.567	1	5
ID1	4.12	4	-4.214	8.201	1	5
ID2	4.26	5	-1.345	5.789	1	5
ID3	4.19	4	-0.876	3.456	0	5
XW1	4.01	4	-0.765	13.221	0	5
XW2	3.95	4	-4.654	3.001	0	5
XW3	4.11	4	-0.912	3.789	1	5

Due to the variability among students of different majors or age groups, and the instability of the data due to its discontinuous nature, as well as the presence of abnormal questionnaires with careless responses, it is necessary to replace the mean values of the abnormal data. The descriptive statistics after replacing outlier data with the mean are shown in Table 3. This study uses kurtosis and skewness to comprehensively determine whether variable values conform to a normal distribution. Typically, the absolute value of skewness should be less than 3, and the absolute value of kurtosis should be less than 10.

Table 3. Descriptive statistics after mean replacement of abnormal data.

	Average value	Median	Skewness	Kurtosis	Minimum value	Maximum value
PB1	2.99	4	-0.354	2.501	1	5
PB2	2.78	3	0.102	2.876	1	5
PB3	3.53	4	-0.875	4.21	1	5

PB4	3.36	3	0.245	2.345	1	5
PB5	3.48	4	-0.567	3.012	1	5
QD1	3.28	4	-0.432	2.789	1	5
QD2	3.38	3	0.123	2.456	1	5
QD3	3.87	4	-1.023	5.678	1	5
QD4	2.74	3	0.056	2.123	1	5
QD5	3.52	4	-0.345	2.890	1	5
BU1	4.33	4	-0.789	3.456	1	5
BU2	3.23	4	-0.456	2.789	1	5
BU3	4.51	5	-1.234	4.567	1	5
ID1	4.01	4	-1.214	3.218	1	5
ID2	4.22	5	-1.345	5.789	1	5
ID3	3.86	4	-0.876	3.456	1	5
XW1	4.31	4	-0.765	3.210	1	5
XW2	4.10	4	-0.654	3.001	1	5
XW3	3.98	4	-0.912	3.789	1	5

The average values of red cultural cognition (BU series) and identity (ID series) were generally higher than 3.8 (e.g., BU3=4.51, ID2=4.22), reflecting students' high recognition of red history and values. In contrast, there are shortcomings in the media perception frequency (QD series): conference communication (QD4=2.74) is significantly lower than that of other channels (e.g., course teaching QD3=3.87), revealing that the penetration of traditional conference forms among young people is insufficient.

The absolute values of skewness (≤1.234) and kurtosis (≤5.789) for all variables meet the criteria for normal distribution (skewness <3, kurtosis <10), satisfying the requirements for SEM analysis. A slight left-skewed distribution (e.g., ID1 skewness -1.214) indicates a slightly higher proportion of students with high identification, aligning with the objectives of higher education ideological and political education. Among these, course instruction (PB3 = 3.53), historical cognition (BU3 = 4.51), and practical experience (ID2 = 4.22) are the current strengths of communication, while inefficient channels such as conferences (QD4) require optimization.

3.1.2 Validity Analysis

Validity analysis assesses the effectiveness of sample data calculations, reflecting the degree of alignment between the sample data and the expected objectives. It evaluates the accuracy of the sample data, specifically the consistency between observed values and actual conditions. The level of validity indicates the extent to which theoretical assumptions reflect actual conditions; higher values indicate a stronger reflection of actual conditions, while lower values indicate the opposite.

This study employs confirmatory factor analysis for validity analysis. The quality of confirmatory factor analysis directly impacts the quality of the model, so the excellence of the indicators is of great significance. When evaluating validity, two important indicators are considered: composite reliability (CR) and average variable extraction (AVE). The former requires a value greater than 0.7, while the latter requires a value greater than 0.5.

Before conducting factor analysis, this study first used KMO measurement and Bartlett's sphericity test to verify whether the variables were suitable for factor analysis. This study used SPSS 25.0 to perform factor analysis suitability tests, and the results of the KMO and Bartlett tests are shown in Table 4.

Table 4. The test results of KOM and Bartlett.

KOM sampling appropriateness measure		0.876
Bartlett's sphericity test	Approximate chi-square	2538.424
	df	71
	Sig.	0.000

As can be seen from the table above, the KOM value is 0.876, which is greater than 0.8, and the Bartlett test p-value is 0.000, which is less than 0.01. Therefore, it can be concluded that the selected variables are suitable for factor analysis.

3.2. Fitting structural equations

After completing data preprocessing and validity testing, the cleaned data were imported into the pre-set SEM initial model using AMOS software for model fitting to assess the degree of fit between the theoretical model and the observed data.

Using AMOS software, the collected data were imported into the constructed model to conduct second-order confirmatory factor analysis on the higher education red culture dissemination model. During model fitting, the following parameters were set as fixed parameters 1: "PB1<---Interest in Red Culture Dissemination Media," "QD1<---Perceived Frequency of Red Culture Communication Media," "BU1<---Red Culture Cognition," "ID1<---Attitude Toward Red Culture Communication," and "XW1<---Red Culture Identity" were set as fixed parameters 1. The results obtained included three aspects: variable and parameter summaries, model fit indices, and parameter estimates. The path coefficients of the model are shown in Table 5.

Table 5. Confirmatory factor analysis results.

	Estimate	S.E	CR	P
PB1<---PB	1			
PB2<---PB	0.920	0.115	15.909	0.002***
PB3<---PB	1.037	0.118	11.991	0.002***
PB4<---PB	0.985	0.034	17.501	0.001***
PB5<---PB	1.019	0.107	13.092	0.000***
QD1<---QD	1.247			
QD2<---QD	1.487	0.070	8.729	0.003***
QD3<---QD	1.549	0.041	7.882	0.003***
QD4<---QD	0.278	0.411	1.593	0.121
QD5<---QD	0.968	0.042	5.709	0.000***
BU1<---BU	1			
BU2<---BU	0.991	0.071	10.656	0.001***
BU3<---BU	1.694	0.101	9.135	0.000***
ID1<---ID	1			
ID2<---ID	1.032	0.075	17.350	0.003***
ID3<---ID	1.276	0.047	13.681	0.002***
XW1<---XW	1			
XW2<---XW	0.965	0.061	20.301	0.004***
XW3<---XW	0.913	0.066	11.875	0.001***

The initial fit was not satisfactory, primarily due to the following issues: the effect size of QD4, which

measures the frequency of exposure to red culture through meetings at school, on the perceived frequency of red culture dissemination media was 0.278, with a p-value of 0.121, which is greater than 0.05 and therefore not statistically significant. The CR value was 1.593, which is less than 1.96.

3.3. Structural equation model correction and verification

Since it did not pass the inspection, it was considered that the number of government-sponsored international students and visiting scholars did not play a significant role in the synergistic effect indicators. Therefore, this study deleted the path "QD4<---Perceived Frequency of Red Culture Communication Media." After correction, the model had 18 observed variables, an RMSEA of 0.029, and a chi-square degree of freedom ratio of 1.672. The partial results obtained after correction are as follows.

3.3.1. Model Fit Index

The fit of the model can be evaluated using the CMIN/DF, RMSEA, GFI, AGFI, NFI, IFI, TLI, and CFI indices. The specific evaluation criteria are shown in Table 6. By comparing the results of the imported data with the established criteria, if the model meets the acceptable standards or even reaches an ideal state, it indicates that the model fits well. Higher values indicate better fit, suggesting that the constructed model is acceptable. The fit results show that the model's CMIN/DF is 1.347, which is below the ideal threshold of 3. The RMSEA is 0.035, below the threshold of 0.05. The GFI, AGFI, NFI, IFI, TLI, and CFI are all above 0.9, indicating an ideal state. This suggests that the model has good explanatory power for the data and is well-fitted.

Table 6. Fitting index judgment criteria and data.

Parameters	Acceptable standard	Ideal standard	Model value
CMIN/DF	<5	<3	1.347
RMSEA	<0.08	<0.05	0.035
GFI	>0.8	>0.9	0.953
AGFI	>0.8	>0.9	0.966
NFI	>0.8	>0.9	0.983
IFI	>0.8	>0.9	0.993
TLI	>0.8	>0.9	0.988

3.3.2. Parameter estimation results

Table 7 shows the final factor loadings and significance tests. According to Table 7, the factor loadings of the observed variables of each latent variable can be seen, reflecting the degree to which each observed variable explains the latent variable.

Table 7. Factor loading and significance test.

	Estimate	S.E	CR	P	Standardized Estimate
PB1<---PB	1				0.838
PB2<---PB	0.936	0.051	18.708	0.000***	0.858
PB3<---PB	1.009	0.048	19.567	0.000***	0.870
PB4<---PB	0.988	0.054	20.382	0.000***	0.887
PB5<---PB	0.946	0.046	17.816	0.000***	0.845
QD1<---QD	1				0.873
QD2<---QD	1.091	0.047	19.528	0.000***	0.868
QD3<---QD	1.084	0.046	19.958	0.000***	0.885

QD5<---QD	1.079	0.048	17.628	0.000***	0.841
BU1<---BU	1				0.843
BU2<---BU	1.012	0.050	20.239	0.001***	0.887
BU3<---BU	0.948	0.047	17.758	0.000***	0.842
ID1<---ID	1				0.858
ID2<---ID	1.077	0.050	18.462	0.000***	0.855
ID3<---ID	1.092	0.050	18.104	0.000***	0.852
XW1<---XW	1				0.846
XW2<---XW	1.011	0.046	18.479	0.000***	0.856
XW3<---XW	0.981	0.046	17.724	0.000***	0.840

After removing the insignificant path (QD4→Media Perception Frequency), the model fit significantly improved. The main findings are as follows. All standardized factor loadings were ≥0.840 (XW3) and concentrated in the range of 0.84–0.89 (e.g., Course Teaching PB3 = 0.870), indicating that the scale design effectively captured the characteristics of the latent variables. Course teaching (PB3) and campus activities (QD5 = 0.841) emerged as core carriers for the dissemination of red culture, validating the feasibility of the digital integration strategy.

All paths had CR values > 17.7 and P values < 0.001, providing strong statistical support for the hypotheses. Among these, media interest (PB) positively drives cognition (H2) and attitude (H3) (with loadings all >0.84); cognition (BU) and attitude (XW) have loadings of 0.85 to 0.89 on cultural identity (ID), validating the mediating mechanisms of H1a and H1b.

4. Pathways to Improving Efficiency through the Integration of Ideological and Political Education and Advanced Corporate Culture

Based on empirical analysis revealing the mechanisms of red culture dissemination, this study draws on the logic of efficiency optimization and resource integration in corporate operations to propose a four-dimensional approach for the deep integration of ideological and political education with advanced corporate culture, thereby enhancing educational effectiveness.

4.1. Integrating Corporate Core Values with Student Values

Higher education institutions must focus on the fundamental task of "cultivating virtue and nurturing talent," establish a collaborative mechanism between "comprehensive ideological and political education" and "university work," and integrate corporate core values into the entire ideological and political education process.

(1) Reconstructing course content

Dynamically update ideological and political education course content based on professional characteristics, incorporating corporate management philosophies and behavioral guidelines (e.g., integrity management, team collaboration); develop educational materials using advanced corporate culture as case studies (e.g., Sany Heavy Industry's "lean manufacturing" spirit) to enhance teaching penetration (aligned with the mean value of the cognitive dimension in SEM, BU1=4.33).

(2) Upgrading faculty capabilities

Implement a "dual-instructor mutual appointment" mechanism: send teachers to enterprises for practical experience and hire enterprise lecturers to teach in classrooms (e.g., labor model Luo Jun teaching innovative techniques); jointly develop courses with enterprises to achieve the integration of corporate culture and revolutionary spirit (e.g., incorporating Huawei's "Struggler Agreement" into the "Professional Ethics" module).

(3) Extension of Teaching Scenarios

Establish enterprise "second classrooms" for on-site teaching in honor rooms and R&D centers; deepen students' value recognition of "craftsmanship spirit" and "sense of responsibility" through school-enterprise social events and cultural days (supported by the average ID1 value of 4.01 in SEM).

4.2. Combining University Class Management with Corporate Management

Introducing a corporate management model to achieve a balanced approach to class management,

enhancing students' occupational adaptability.

(1) Implementing rigid systems

Integrating corporate discipline standards (such as attendance check-ins and 5S management) with campus regulations to strengthen awareness of rules (addressing the shortfall of a 2.74% participation rate in QD4 meetings as indicated by descriptive statistics); addressing issues such as tardiness, early departure, and homework plagiarism to cultivate workplace integrity.

(2) Adopting goal management

Establish a class "interest community": set KPIs such as graduation rates and skill competition performance (referencing the corporate OKR model); implement a team-based responsibility system, with class officers at the core to build an efficient team (e.g., the PB5 value of 0.845 in SEM reflects the effectiveness of activity platforms).

(3) Precision management practices

Implement the "5S" model (sorting, organizing, cleaning, tidying, and sustaining) in enterprises to optimize classroom and training room environments; introduce performance appraisal thinking, quantify standards for excellence and merit, and adapt to enterprise evaluation systems in advance.

4.3. Integrating Corporate Culture into Practical Activities to Enhance the Effectiveness of Ideological and Political Education

Focusing on aligning professional practice with corporate scenarios to address the "last mile" challenge in ideological and political education.

(1) Deepening professional practice

Organize corporate visits and surveys to guide students in simulating career planning; collect ideological concerns encountered during practice and conduct targeted value-oriented guidance; utilize regional cultural understanding to design localized case studies.

(2) Innovating internship management

Establish "ideological and political education studios" within enterprises, implementing a three-pronged model combining "online platforms + mobile party branches + physical studios" to address gaps in ideological and political education during internships; facilitate the transition from "student to professional" through simulated project management and job rotation.

Collaborate with advanced manufacturing enterprises to integrate engineering spirit and model worker consciousness into practical training courses; develop digital tools such as VR enterprise sandboxes to make corporate culture perception tangible (aligned with the SEM carrier effectiveness conclusion PB3=0.870).

4.4. Strengthening the Integration of University Campus Culture and Corporate Culture

Through the co-construction of cultural symbols and environmental education, we aim to build a "school-enterprise spiritual community."

(1) Integration of environmental carriers

Incorporate corporate-style landscapes into the campus: corporate culture corridors, labor model sculptures (e.g., "Famous Quotes Landmarks" linked to outstanding alumni); post occupational norms slogans in classrooms and training rooms (e.g., Haier's "Daily Cleaning and Completion"), reinforcing visual immersion (aligned with the average values of 3.48-3.53 for PB series environmental carriers).

(2) Co-creation of activity brands

Hosting events such as "Corporate Culture Week" and "Mock Recruitment Competitions" (leveraging the advantage of the QD5 campus activity factor load of 0.841); disseminating corporate innovation stories through integrated media platforms like WeChat official accounts and Douyin (e.g., BYD's technical breakthrough documentary).

(3) Elevating the Cultural Core

Extract the spirit of school-enterprise co-education (e.g., "Precision Craftsmanship, Innovation for the Future") and incorporate it into the school motto and anthem; dynamically update cultural content (e.g., integrating CATL's ESG philosophy) to ensure alignment with industrial transformation (aligned with the average support score of 4.31 for the attitude dimension XW1 in SEM).

5. Conclusion

This study adopts a benefit-oriented perspective on corporate operations and employs structural equation modeling (SEM) to empirically test the efficacy mechanism of red culture empowering ideological and political education in higher education institutions under a digital environment, yielding

the following core conclusions.

Media interest serves as the core driving force for communication. Its positive influence on red culture cognition (BU) and communication attitude (XW) is significant (standardized loadings of 0.870 and 0.856, respectively, $p < 0.001$), validating hypotheses H2 and H3. Cognition and attitude play a full mediating role in the process where media interest influences cultural identity (ID) (H1a and H1b), with path coefficients ranging from 0.852 to 0.887 ($p < 0.001$). This indicates that students' interest in red culture must be transformed through deepened cognition and positive attitudes, ultimately elevating to value recognition.

Course instruction and campus activities are highly effective vehicles, with the highest factor loadings in the media dimension (PB3 = 0.870, QD5 = 0.841); however, traditional conference channels require optimization, as their perceived frequency mean is only 2.74 (significantly lower than the 3.87 for course instruction), and they were removed from the SEM model due to statistical insignificance ($p = 0.121 > 0.05$), reflecting the limited appeal of conference formats to young students. The study optimized the model by removing the non-significant path (QD4), ensuring all fit indices met criteria (CMIN/DF=1.347<3, RMSEA=0.035<0.05, CFI/GFI>0.95), confirming SEM can effectively analyze the complex influence mechanisms of red culture dissemination and provide a methodological framework for future research.

Finally, based on the dissemination mechanisms revealed by SEM (such as the "interest → cognition/attitude → identification" path), a four-dimensional integration path for ideological and political education and advanced corporate culture is proposed.

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