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Research on the Construction of a Mechanism for Enhancing Teachers' Information Literacy in the Context of Digital Transformation and Faculty Development in Higher Education Institutions

Heyang Yang[1,*]
[1] Personnel Department, Lianyungang Technical College, Lianyungang, Jiangsu, 222000, China
Corresponding authors: (e-mail: lzyyhy312@163.com).

Abstract Teachers' information literacy is the core competency for educators engaged in educational and teaching activities in an information-driven environment, and it serves as a critical lever for enhancing educational quality across society. This study examines the influence of six key factors—effort expectations, community influence, convenience, anxiety, self-efficacy, and individual motivation—on teachers' information literacy in the context of university faculty development, as well as the interactive relationships among these factors. Based on the PLS-SEM model, the study constructs a theoretical framework for the mechanisms influencing teachers' information literacy in university faculty development and designs a questionnaire for statistical analysis. The research results indicate that effort expectations, community influence, convenience conditions, and anxiety have a significant positive impact on teachers' information literacy. Among these factors, anxiety has the strongest positive impact on basic information literacy and professional information literacy (0.591 and 0.545, respectively). Self-efficacy and individual motivation exhibit mediating effects in enhancing teacher information literacy in university faculty development. Finally, the study explores new pathways, methods, and models for enhancing teacher information literacy from three dimensions—value, practice, and innovation—providing insights and references for improving teacher information literacy in higher education.

Index Terms PLS-SEM model, mediating effect, teacher information literacy, statistical analysis

I. Introduction

The digital transformation of education is an inevitable requirement of "Digital China," "Digital Economy," and "Smart Society." As China's educational digital transformation rapidly develops, higher education also faces severe challenges in the process of informatization [1]. The development of digital technology has not only transformed traditional teaching concepts but has also brought about significant changes in teaching methods and management approaches, exerting a profound influence on school education management. On one hand, integrating digital technology into the higher education process enables the sharing of digital education concepts on a larger scale, facilitating a value transformation driven by digital thinking [2], [3]. On the other hand, digital education has transformed traditional teaching methods and management approaches, shifting teaching scenarios from a "transmission-oriented" model to a "constructivist" model [4], [5].

In basic education, teachers play a unique role as a crucial link in ensuring that high-quality educational resources are effectively delivered to students [6]. Digital literacy is a prerequisite for teachers to effectively conduct educational activities and achieve sustainable development in the digital age [7]. As core participants, practitioners, and promoters of educational digital transformation, teachers' understanding of the value of digital literacy directly determines the influence of digital technology on educational reform [8]-[10]. However, at present, teachers' proficiency in integrating information technology into curriculum, utilizing digital tools for classroom management, and participating in school educational management issues remains relatively lacking [11], [12]. Therefore, enhancing teachers' digital awareness, strengthening their digital technology knowledge and skills, and continuously improving their ability to apply digital technology in teaching activities, optimize teaching processes, and innovate teaching models are imperative for the high-quality development of basic education [13]-[16].

To fully leverage teachers' exemplary and leading roles, conducting teacher training to enhance their digital literacy is the most direct approach. Literature [17] examined pre-service teachers' self-perceived levels of digital competence, finding that teachers generally lack information literacy in content creation and problem-solving. It therefore calls for integrating information and communication technology into pre-service teacher training to enhance teachers' digital literacy. Literature [18] conducted an assessment of teachers' digital competence development during the lifelong learning phase, revealing deficiencies in teachers' digital competence in areas such as instructional content creation. It emphasized that developing teachers' digital instructional competence through training is the sole pathway to driving instructional innovation. Literature [19] underscored the significance of teachers' digital competence in the context of educational informatization transformation, identifying the lack of teacher training and ICT training as key factors contributing to low levels of digital competence among teachers. At the same time, establishing a quantifiable and assessable evaluation mechanism is a crucial guarantee for continuously improving teachers' digital literacy levels. Literature [20] applied the self-assessment tool COMDID-A to teachers' initial training, thereby generating formative assessments of teachers' digital competencies, providing effective support for promoting teacher development and educational institution collaboration. Literature [21] developed a digital literacy assessment tool tailored for teacher self-assessment, which thoroughly investigated the competency domains and perceptual attitudes of teachers across different disciplines, demonstrating high reliability and validity. Literature [22] established a teacher digital literacy assessment indicator system based on the Expert Knowledge Coefficient (EKC), and the resulting teacher digital literacy assessment framework provides important reference for evaluating teacher competencies in t-MOOC courses. Based on the above research, further refine the data-driven teacher digital literacy evaluation system to form new mechanisms and models conducive to the development of university teachers' digital literacy, contributing new insights to advancing educational digital transformation.

The study first conducted a theoretical analysis of the six factors influencing teacher information literacy in university faculty development: community influence, individual motivation, convenience conditions, anxiety, self-efficacy, and effort expectations. Teacher information literacy was then divided into three parts: basic information literacy, professional information literacy, and research information literacy. Based on existing research and interview results, the study identifies the factors influencing the development of university teachers' information literacy and hypothesizes the relationships among these factors. Using the PLS-SEM model, it constructs a mechanism model of the influence of teachers' information literacy on university faculty team development. Finally, we designed a questionnaire based on existing questionnaire designs related to the factors influencing teachers' information literacy and combined it with the actual interview situation. We used SPSS and AMOS software for data statistical analysis, verified the research hypotheses based on the questionnaire survey data, and conducted a series of data processing, including confirmatory factor analysis, mediation effect testing, and path analysis, to ultimately determine the influence factor model for the development of teachers' information literacy in university faculty team building, thereby exploring the path for improving teachers' information literacy.

II. Construction of a model of the influence mechanism of teacher information literacy based on PLS-SEM

II. A. PLS-SEM model

II. A. 1) Structural equation model

Structural equation modeling (SEM) is a statistical method that was first applied in psychometrics and econometrics, and has since been increasingly used in sociology. It is highly regarded because it is a versatile multivariate analysis technique that combines two important statistical techniques: factor analysis and path analysis [23]. Among common multivariate analysis techniques, such as multivariate analysis of variance, canonical correlation analysis, conjoint analysis, and multiple regression analysis, most deal with the relationship between a single dependent variable and independent variables. In contrast, structural equation modeling can handle a set of dependent variables and independent variables (at least two) and can be used to analyze variables with interrelated relationships. SEM encompasses various models ranging from linear regression to measurement models to simultaneous equations, including confirmatory factor analysis (CFA), related uniqueness models, latent growth models, multiple indicators multiple causes (MIMIC) models, and item response theory (IRT) models.

II. A. 2) Partial Least Squares Structural Equation Modeling

PLS-SEM can be divided into two parts: the measurement model (external model) and the structural model (internal model), as shown in Figure 1. The measurement model describes the relationship between latent variables and measurement variables, while the structural model describes the interrelationships between latent variables.

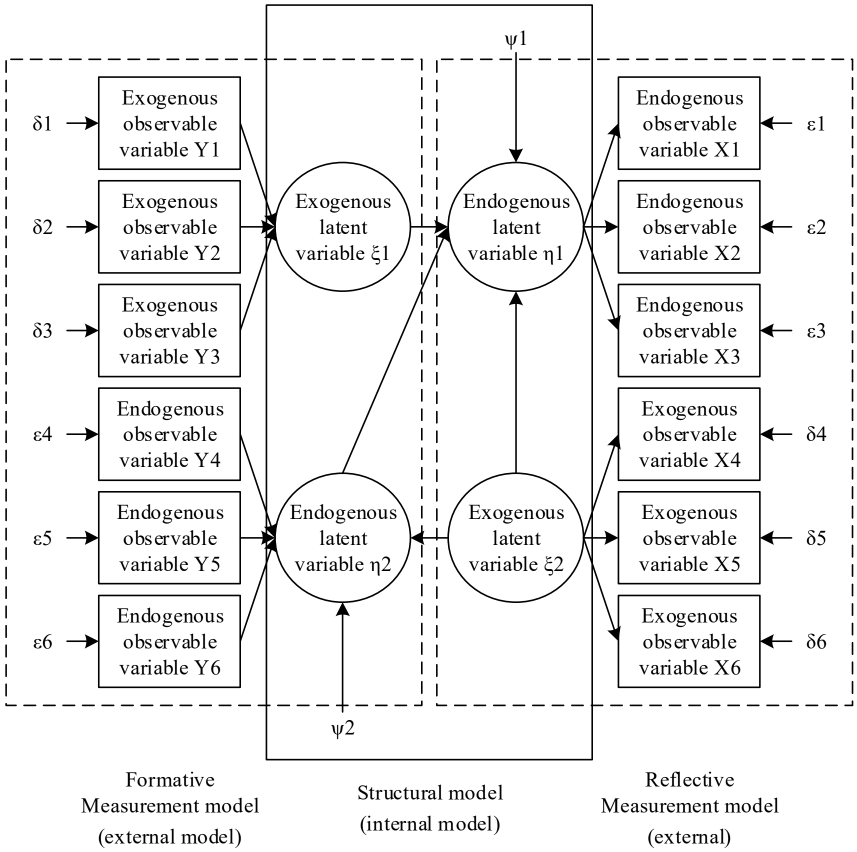

Figure 1: The model of the partial least squares structure equation

For the formative measurement model, the corresponding measurement equation is as follows:

$$\begin{aligned} \xi_1 &= \lambda_{Y1} Y_1 + \delta_1 \quad \eta_2 = \lambda_{Y4} Y_4 + \varepsilon_4 \\ \xi_1 &= \lambda_{Y2} Y_2 + \delta_2 \quad \eta_2 = \lambda_{Y5} Y_5 + \varepsilon_5 \\ \xi_1 &= \lambda_{Y3} Y_3 + \delta_3 \quad \eta_2 = \lambda_{Y6} Y_6 + \varepsilon_6 \end{aligned} \tag{1}$$

Among these, ξ_1 and η_2 are exogenous latent variables and endogenous latent variables, respectively, while Y_1, Y_2, and Y_3 are exogenous observed variables, and Y_4, Y_5, Y_6 are endogenous observed variables, $\lambda_{Yn}\left(n=1,2,\cdots,6\right)$ are regression coefficients, δ_1, δ_2, δ_3, and ε_4, ε_5, ε_6 are the residuals. For the reflective measurement model, the corresponding measurement equations are as follows:

$$\begin{aligned} X_1 &= \lambda_{X1} \eta_1 + \varepsilon_1 \quad X_4 = \lambda_{X4} \xi_2 + \delta_4 \\ X_2 &= \lambda_{X2} \eta_1 + \varepsilon_2 \quad X_5 = \lambda_{X5} \xi_2 + \delta_5 \\ X_3 &= \lambda_{X3} \eta_1 + \varepsilon_3 \quad X_6 = \lambda_{X6} \xi_2 + \delta_6 \end{aligned} \tag{2}$$

Among these, η_1 and ξ_2 are endogenous latent variables and exogenous latent variables, respectively, X_1, X_2, and X_3 are endogenous observed variables, X_4, X_5, X_6 are exogenous observed variables, $\lambda_{Xn}\left(n=1,2,\cdots,6\right)$ are load coefficients, and ε_1, ε_2, ε_3, δ_4, δ_5, and δ_6 are residuals.

For the structural model, the corresponding measurement equations are as follows:

$$\eta_1 = \gamma_{\eta_2} \eta_2 + \gamma_{\xi_1} \xi_1 + \gamma_{\xi_2} \xi_2 + \psi_1 \tag{3}$$

Among these, η_1 and η_2 are endogenous latent variables, ξ_1 and ξ_2 are exogenous latent variables, γ_{η_2}, γ_{ξ_1}, and γ_{ξ_2} are path coefficients, and ψ_1 is the residual.

The PLS-SEM calculation method consists of two stages. The first stage involves repeatedly calculating the estimated values of the latent variables (5 steps), and the second stage involves calculating the coefficients (2 steps).

1) First stage

(1) Standardize the manifest variables X

Standardize each explanatory variable so that its mean is 0 and its variance is 1. The explanatory variable $X_i = (x_{i1}, x_{i2}, \cdots, x_{im})$ is calculated using the formula $x'_{ij} = \frac{x_{ij} - \overline{x}_i}{\sigma_{xi}}$, such that $X'_i = (x'_{i1}, x'_{i2}, \cdots, x'_{im})$, then $E(X'_i) = 0$ and $Var(X'_i) = 1$.

(2) External approximation estimation of the latent variable Y

First, use the measurement model to estimate the weight coefficients ω of the observed variables X, then combine the observed variables X to estimate the approximate values of the latent variables Y in the measurement model. The formula for the exogenous estimate of the latent variables Y is:

$$Y_i^{t+1} = f_i^{t+1}\left(\omega_i^t \cdot X_i\right) \tag{4}$$

Among these, Y_i^{t+1} is the vector value of the external estimate after the t th iteration for the latent variable Y; ω_i^t is the weight of the manifest variable X_i; f_i^{t+1} is the iterative weight such that $Var\left(Y_i^{t+1}\right) = 1$; t is the iteration label.

(3) Internal approximate estimation of the latent variable ξ

First, use the latent variable Y approximated by the measurement model to estimate the path coefficients λ in the structural model. Then, use the latent variable Y approximated by the measurement model and the path coefficients λ to re-estimate the approximate values of the latent variables in the structural model. The formula for the intrinsic estimate of the latent variable ξ is:

$$\xi_i^{t+1} = f_i^{t+1}\left(\lambda_i^{t+1} \cdot Y_i^{t+1}\right) \tag{5}$$

Among these, ξ_i^{t+1} are the intrinsic estimated value vectors of the latent variables ξ_i after the t th iteration; λ_i^{t+1} are the internal weights of the latent variables; $f_i^{\eta t+1}$ is a scalar such that $Var(\xi_i^{t+1}) = 1$; t is the iteration label.

(4) Estimate the weight coefficients ω of the measurement model.

Estimate the weight coefficients ω of the measurement model using the intrinsic estimated values ξ of the latent variables and the manifest variables X.

For the formative measurement model weight estimation, use the formula:

$$\xi_i^{t+1} = \omega_i^{t+1} \cdot X_i + \delta_i^{t+1} \tag{6}$$

The formula used for estimating the weights of the reflective measurement model is as follows:

$$X_i = \omega_i^{t+1} \xi_i^{t+1} + \varsigma_{X_i}^{t+1} \tag{7}$$

(5) Determining the iteration termination criteria

After performing steps (2) to (4), determine whether the iteration termination conditions have been met. If not, continue to perform steps (2) to (4) to iterate the calculation. Generally, the following formula is used to determine whether to terminate the iteration: when $|\omega_{ij}^t - \omega_{ij}^{t+1}| < 10^{-5}$ or $\left|\frac{\omega_{ij}^t - \omega_{ij}^{t+1}}{\omega_{ij}^t}\right| < 10^{-5}$, the iteration can be stopped.

2) Second stage

(1) Calculate the values of latent variables

Based on the iterative calculations from the first stage, determine the weight coefficients in combination with the manifest variables to calculate the latent variables using the following formula:

$$\xi_i^T = \omega_i^T \cdot X_i \tag{8}$$

In this context, the superscript T denotes the computational results obtained after T iterations.

(2) Calculate the load coefficients of the measurement equations and the path coefficients of the structural equations.

the path coefficients of the structural equations; using all latent variables (calculated in Step 1) and the values of the observed variables, perform ordinary least squares regression to calculate the load coefficients of the measurement equations.

PLS-SEM includes measurement models and structural models, and the results obtained include the coefficients and paths of the measurement equations and structural equations. The evaluation is relatively complex and requires testing the variable parameters of the measurement equations and structural equations, as well as the fit of the entire model. Although there are many methods for testing structural equation models, there is no mature testing system. Therefore, I used the most commonly used testing methods, as follows:

Path coefficient testing involves verifying whether the coefficients in the model are significantly different from zero. The Bootstrapping method is used for testing, constructing the t statistic. When the t value is 2.58, the significance level is 1%; 1.96 corresponds to a significance level of 5%, and 1.65 corresponds to a significance level of 10%. Alternatively, one can directly observe whether the P value falls within the 1%, 5%, or 10% significance range.

II. B.Establishing factors influencing teachers' information literacy

II. B. 1) Efforts and expectations

Effort expectation refers to the ease with which users perceive the use of a particular information system or new technology. The easier users find it to operate, the more positive their attitude toward using the system will be. Therefore, it is believed that during the initial stages of a new behavior, effort expectation has a more significant influence on users. Consequently, the acceptance of information technology by university faculty depends on whether the information technology system is easy to use.

II. B. 2) Community Impact

Social influence refers to the influence of the thoughts and behaviors of a specific person or group of people around a user on their decision to use a particular information system. Individuals are always influenced by others, especially those they consider to be very important to them. Social influence significantly affects teachers' intentions to use information technology. This study argues that social influence is a determining factor in college teachers' intentions to use information technology.

II. B. 3) Convenient conditions

Convenient conditions refer to the conditions necessary for users to use a certain information technology smoothly, as well as various corresponding support equipment. Convenient conditions will relatively increase users' usage behavior.

II. B. 4) Anxiety

Anxiety refers to the degree of trust that users have in information technology, especially emerging information technologies. It directly affects individuals' behavior in using information technology. This study argues that anxiety is an important factor influencing college teachers' behavior in using information technology.

II. B. 5) Self-efficacy

Self-efficacy refers to the totality of the time, effort, and other costs that users perceive they must expend when using information technology. It significantly influences individuals' intentions to use information technology. This study posits that self-efficacy is a key factor in the use of information technology by college teachers.

II. B. 6) Individual Motivation

Individual motivation plays a guiding, directing, and sustaining role in teachers' professional development, and individual motivational factors directly influence teachers' behavior. Different motivations have different effects on the development of teachers' information literacy, and external environmental pressures are not conducive to the development of teachers' innovative abilities.

II. C.Building a model of how teachers' information literacy affects stuff

This section primarily employs the PLS-SEM model to investigate the mechanisms influencing teachers' information literacy, based on the theoretical framework of factors affecting teachers' information literacy outlined in the preceding section. Therefore, the mechanisms influencing teachers' information literacy are examined from six aspects: effort expectations, community influence, convenience conditions, anxiety, self-efficacy, and individual motivation. Research hypotheses are proposed, and a model is constructed based on these hypotheses.

The initial model of the factors influencing the development of teachers' information literacy is shown in Figure 2. In this hypothetical model, the influencing factors primarily include effort expectations, community influence, convenience conditions, anxiety, self-efficacy, and individual motivation. Among these, effort expectations, community influence, convenience conditions, and anxiety are external variables, self-efficacy and individual motivation are mediating variables, and basic information literacy, professional information literacy, and research information literacy are internal variables.

Research hypotheses:

H1: Community influence has a significant positive impact on self-efficacy.

H2: Community influence has a significant positive impact on individual motivation.

H3: Individual motivation has a significant positive impact on the basic information literacy of university teachers.

H4: Individual motivation has a significant positive effect on the professional information literacy of university teachers.

H5: Individual motivation has a significant positive effect on the research information literacy of university teachers.

H6: Convenience conditions have a significant positive effect on the professional information literacy of university teachers.

H7: Convenience conditions have a significant positive effect on the research information literacy of university teachers.

H8: Convenience conditions have a significant positive effect on individual motivation.

H9: Anxiety has a significant positive impact on the basic information literacy of university teachers.

H10: Anxiety has a significant positive impact on the professional information literacy of university teachers.

H11: Anxiety has a significant positive impact on the research information literacy of university teachers.

H12: Self-efficacy has a significant positive impact on the professional information literacy of university teachers.

H13: Self-efficacy has a significant positive impact on the research information literacy of university teachers.

H14: Effort expectations have a significant positive impact on the professional information literacy of university teachers.

H15: Effort expectations have a significant positive impact on the research information literacy of university teachers.

H16: Effort expectations have a significant positive impact on the self-efficacy of university teachers.

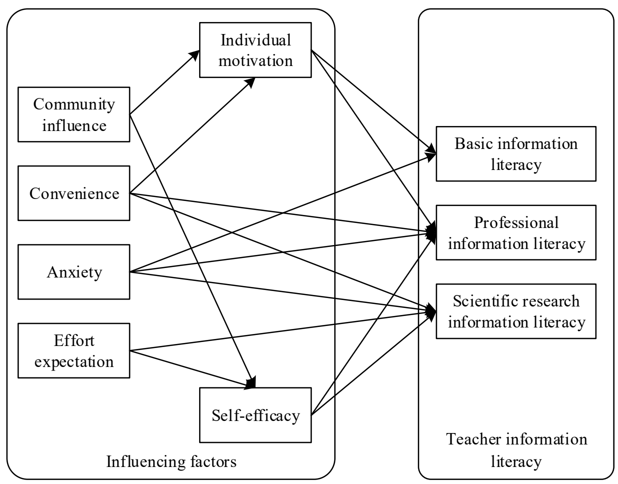

Figure 2: Influence factor model of teacher information literacy development

III. Research Design and Implementation

III. A. Questionnaire Design

The study collected the required primary data through a questionnaire survey. The questionnaire design included two main sections: personal basic information and the core measurement dimensions. The personal basic section comprised basic information about teachers at local universities and control variables based on the research model, including four measurement items: gender, highest level of education, years of teaching experience, and professional title. The study primarily analyzed whether differences in gender, highest level of education, years of teaching experience, and professional title influence teachers' willingness to use information technology in teaching at local universities. Table 1 shows the overall structure of the scale.

The main section draws on the original model and combines relevant domestic and international research to propose six variables that influence local university teachers' willingness to use information technology in teaching, and designs 3 to 6 corresponding measurement items for each variable. The design of each measurement item references scales with good reliability and validity from existing relevant literature, and is adjusted and modified based on the characteristics of the research subjects and the research objectives.

The research scale uses a five-point interval scale for measurement: “Strongly Agree” is scored as 5 points, “Agree” as 4 points, “Neutral” as 3 points, ‘Disagree’ as 2 points, and “Strongly Disagree” as 1 point; For negative items, the scoring method is reversed: “Strongly Agree” is scored as 1 point, “Agree” as 2 points, “Neutral” as 3 points, ‘Disagree’ as 4 points, and “Strongly Disagree” as 5 points.

Table 1: Overall structure of scale

Variable	Index coding	Item
Effort expectation	EE	EE1
		EE2
		EE3
Community impact	CI	CI1
		CI2
		CI3
		CI4
		CI5
Convenience condition	CC	CC1
		CC2
		CC3
		CC4
Anxiety	AN	AN1
		AN2
		AN3
Self-efficacy	SE	SE1
		SE2
		SE3
		SE4
Individual motive	IM	IM1
		IM2
		IM3
		IM4
		IM5
Information literacy	IL	IL1
		IL2
		IL3
		IL4
		IL5
		IL6

III. B. Sample Selection and Survey

To ensure the quality of the survey questionnaire, this study conducted a small-scale pilot test on the initial survey questionnaire prior to the formal survey (typically with a sample size not exceeding 100). The author conducted a pre-survey of teachers at School A in Guangzhou using an online survey questionnaire, and a total of 80 valid questionnaires were returned. Subsequently, the author used SPSS to conduct reliability and validity tests and exploratory factor analysis on the pre-survey data. The analysis results showed that six common factors were extracted from the measurement items. The reliability coefficients (Cronbach's α) for all six factors were greater than 0.7, and the KMO values were greater than 0.5, indicating that the questionnaire design has good reliability and validity. Therefore, the questionnaire identifying the influencing factors of vocational skills course teaching quality evaluation based on the 30 indicator questions was finalized as the final survey questionnaire. This study distributed the questionnaire to college teachers nationwide through an online survey platform, with a total of 400 responses received, including 385 valid questionnaires, yielding a validity rate of 96.25%.

III. C. Questionnaire Data Analysis

III. C. 1) Reliability testing of the survey questionnaire

Assessing the quality of survey questionnaire data is a crucial prerequisite for ensuring the validity of subsequent analyses. This study employs Cronbach's alpha reliability testing to analyze the internal consistency of each variable, primarily utilizing the “Reliability Analysis” function in SPSS to measure the Cronbach's alpha reliability coefficient (i.e., Cronbach's alpha) of the sample data. Generally, a Cronbach's α coefficient above 0.7 indicates that the questionnaire has good internal consistency. The Cronbach's α coefficient ranges from 0 to 1, and the higher the coefficient value, the higher the reliability.

Table 2 presents the reliability analysis of the questionnaire's variables. The measurement model for the factors influencing teachers' information literacy in university faculty development includes seven latent variables with a total of 30 valid measurement items. All latent variables have a Cronbach's α coefficient of at least 0.899, and the overall Cronbach's α coefficient reaches 0.952, all exceeding the 0.7 threshold. This indicates that the reliability of the measurement questionnaire for this model is relatively good, and the data reliability is high.

Table 2: Analysis of the various variables of the questionnaire

Variable	Index coding	Item	Subject quantity	Cronbach's α
Effort expectation	EE	EE1	3	0.901
		EE2		
		EE3		
Community impact	CI	CI1	5	0.922
		CI2		
		CI3		
		CI4		
		CI5		
Convenience condition	CC	CC1	4	0.915
		CC2		
		CC3		
		CC4		
Anxiety	AN	AN1	3	0.926
		AN2		
		AN3		
Self-efficacy	SE	SE1	4	0.899
		SE2		
		SE3		
		SE4		
Individual motive	IM	IM1	5	0.911
		IM2		
		IM3		
		IM4		
		IM5		
Information literacy	IL	IL1	6	0.921
		IL2		
		IL3		
		IL4		
		IL5		
		IL6		

III. C. 2) Validity testing of the survey questionnaire

This section primarily uses exploratory factor analysis to test the structural validity of the questionnaire. First, the KMO value and Bartlett's sphericity test are examined. Generally, a KMO value greater than 0.6 and a significant Bartlett's sphericity test are required for exploratory factor analysis. Table 3 shows the KMO and Bartlett's tests for the scale. The overall KMO value for the scale is 0.951, and the Bartlett's sphericity test is less than 0.05, reaching a significant level. This indicates that the sample data from all three groups are suitable for exploratory factor analysis.

Table 3: KMO and bartlett tests of the scale

KMO and bartlett test		
Sample sufficient degree of the Kaiser-Meyer-Olkin metric		0.951
Bartlett's spherical test	Approximate card	8182.464
	df	385
	Sig.	0.000

Secondly, this study conducted an exploratory factor analysis on the data of 30 items using the “factor analysis” function in SPSS. The specific parameter settings are as follows: the extraction method is “principal component” (taking eigenvalues greater than 1), the rotation method is “maximum variance method,” and the output coefficient display format in the options is “sorted by size” and “exclude small coefficients” (absolute value < 0.5). Table 4 shows the rotated composition matrix of teacher information literacy. After orthogonal rotation, the item data yielded seven common factors with eigenvalues greater than 1, explaining a cumulative variance of 86.396%. This indicates that these seven factors can respectively reflect 86.396% of the information from the 30 items, exceeding the general standard of 80%. This suggests that the measurement model exhibits good structural validity among its variables and that the items possess good explanatory power.

In summary, the formal questionnaires in this study all have good reliability and validity. The sample data collected by the survey questionnaire can relatively accurately reflect teachers' perceptions of the influencing factors of information literacy and can be used for further confirmatory factor analysis.

Table 4: Teacher information literacy affects the rotation composition matrix

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
EE1	0.772						
EE2	0.715						
EE3	0.768						
CI1		0.812					
CI2		0.805					
CI3		0.789					
CI4		0.809					
CI5		0.811					
CC1			0.825				
CC2			0.833				
CC3			0.798				
CC4			0.756				
AN1				0.812			
AN2				0.833			
AN3				0.856			
SE1					0.791		
SE2					0.766		
SE3					0.745		
SE4					0.783		
IM1						0.856	
IM2						0.847	
IM3						0.841	
IM4						0.825	
IM5						0.789	
IL1							0.787
IL2							0.805
IL3							0.813
IL4							0.826
IL5							0.859
IL6							0.878
Eigenvalue	4.592	4.225	3.865	3.711	3.682	3.056	2.788
Variance interpretation	15.307	14.083	12.883	12.37	12.273	10.187	9.293
Cumulative variance interpretation	15.307	29.39	42.273	54.643	66.916	77.103	86.396

IV. Analysis of the mechanism by which teachers' information literacy influences learning outcomes

IV. A. Differential Analysis

IV. A. 1) Gender

Male teachers scored significantly higher than female teachers in research information literacy (P=0.018), while female teachers scored significantly higher than male teachers in basic information literacy (P=0.025). The independent samples t-test for information literacy among university teachers of different genders is shown in Table 5. Through in-depth interviews with four female teachers and two male teachers, it was found that male teachers are more inclined to explore various new software and technologies related to teaching, have a positive attitude toward using big data platforms, and are not confined to basic functions such as the release of learning materials or classroom interaction. Additionally, their awareness of cybersecurity during use is significantly higher than that of female teachers. Female teachers, however, have a clear advantage in innovative concepts and demonstration-based instruction. However, due to their limited information technology theory and computer operation skills, most of them still rely on various teaching platforms to share resources, collect cases related to their specialties, and organize classroom discussions to conduct information-based teaching.

Table 5: Independent sample t test for different gender

Subfactor	Sex	N	M	SD	T	P
Basic information literacy	Female	230	4.825	2.255	-2.251*	0.025
	Male	155	4.723	2.148		
Professional information literacy	Female	230	4.422	2.222	-0.855*	0.442
	Male	155	4.618	2.012		
Scientific information literacy	Female	230	3.762	4.122	-1.123*	0.018
	Male	155	4.015	4.033		

IV. A. 2) Educational background and region of school affiliation

Table 6 presents a comparison of differences in teachers' information literacy recognition among university faculty teams with varying educational backgrounds and regional affiliations. A one-way analysis of variance revealed significant differences in teachers' information literacy implementation across teaching practices, with overall F-values of 2.814 and 3.11, and P-values of 0.025 < 0.05 and 0.044 < 0.05, respectively. Specifically, teachers with master's degrees scored higher than those with bachelor's degrees on both the overall information literacy scale and the three-dimensional sub-scales. Among them, the 15 teachers with doctoral degrees demonstrated a significant advantage on both the overall information literacy scale and the three-dimensional sub-scales. University mathematics teachers in urban areas scored higher on the total information literacy scale and the three-dimensional scales than those in county towns and rural areas. University mathematics teachers in county towns and rural areas had comparable mean scores on the total information literacy scale and the three-dimensional scales.

Table 6: Different degrees and regions

Group name	Variation source	Sum of squares	df	Mean	F	P
Educational background	Module	65.122	5	21.245	2.814*	0.025
	Within group	3233.153	380	7.335		
	Total	3298.275	385			
School area	Module	5.156	5	2.256	3.111*	0.044
	Within group	338.44	380	0.844		
	Total	343.596	385			

IV. B. Correlation Analysis

This study used Pearson correlation analysis [24] to examine the relationships among the seven exogenous variables in this scale. Correlations between 0.10 and 0.29 are considered weak, between 0.30 and 0.49 are moderate, between 0.50 and 0.69 are strong, and above 0.70 are very strong. Table 7 shows the correlations among the seven dimensions of the scale, with variables influencing one another. Among these, dimensions with extremely strong correlations include effort expectations and community influence (0.752) and effort expectations and convenience conditions (0.761). Dimensions with strong correlations include effort expectations and anxiety (0.655), effort expectations and self-efficacy (0.678), effort expectations and individual motivation (0.581), and effort expectations and teacher information literacy (0.602).

Table 7: The correlation between the six dimensions of the scale

	EE	CI	CC	AN	SE	IM	IL
EE	1.000						
CI	0.752**	1.000					
CC	0.761**	0.782**	1.000				
AN	0.655**	0.725**	**0.823****	1.000			

SE	0.678**	0.722**	0.711**	**0.822****	1.000		
IM	0.581**	0.666**	0.711**	0.748**	**0.801****	1.000	
IL	0.602**	0.781**	0.729**	0.801**	0.743**	**0.695****	1.000

IV. C. Hypothesis testing of structural equation models

IV. C. 1) Path Analysis

Based on the revised model of factors influencing the development of teachers' information literacy in the construction of university faculty teams, path analysis was conducted, and the path coefficients and P-values were used to determine whether the research hypotheses were valid. The specific results of the hypothesis tests are shown in Table 8.

Table 8: Hypothesis test results

Numbering	Path	Path Coefficient	P	Conclusion
H1	SE←←CI	0.423	***	Support
H2	IM←←CI	0.477	***	Support
H3	BIL←←IM	0.222	***	Support
H4	PIL←←IM	0.355	***	Support
H5	SIL←←IM	Delete path	---	Unsupport
H6	PIL←←CC	0.411	***	Support
H7	SIL←←CC	0.289	***	Support
H8	IM←←CC	0.333	***	Support
H9	BIL←←AN	0.591	***	Support
H10	PIL←←AN	0.545	0.005	Support
H11	SIL←←AN	0.422	0.008	Support
H12	PIL←←SE	0.501	***	Support
H13	SIL←←SE	0.222	0.001	Support
H14	PIL←←EE	Delete path	---	Unsupport
H15	SIL←←EE	0.325	***	Support
H16	SE←←EE	0.111	0.0005	Support

Using AMOS software, a path coefficient analysis was conducted to examine the factors influencing the development of information literacy among university faculty members. After repeated revisions, the paths between individual motivation and research information literacy, as well as between effort expectations and professional information literacy, did not reach statistical significance. Therefore, hypotheses H5 (individual motivation has a significant positive impact on research information literacy among university teachers) and H14 (effort expectations have a significant positive impact on professional information literacy among university teachers) are not valid, so these two hypothesized paths are removed. The P-values for the remaining hypothesized paths all meet the criterion of being less than 0.05, so the hypotheses are valid, meaning that the independent variables and dependent variables are significantly positively correlated. The final model of the factors influencing the development of information literacy among university faculty members is shown in Figure 3. The extent of influence of each factor is determined by the numerical value of its path coefficient. Anxiety has the strongest positive influence on basic information literacy and professional information literacy (0.591 and 0.545, respectively).

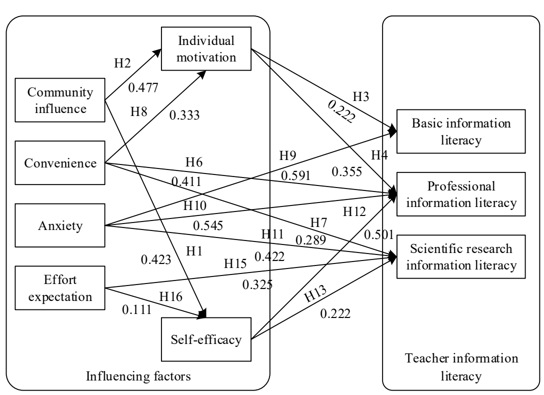

Figure 3: Influence factor model of teacher information literacy development

IV. C. 2) Mediating effect analysis

Table 9 shows the correlations among the variables in the structural model of effort expectation and scientific research information literacy. There is a significant positive correlation between effort expectation and scientific research information literacy, i.e., C is significant. There is a significant positive correlation between effort expectation and self-efficacy, i.e., A is significant; there is a significant positive correlation between self-efficacy and scientific research information literacy, i.e., B is significant, proceeding to the third step of testing. There is no significant positive correlation between self-efficacy and scientific research information literacy, i.e., C' is not significant. According to the mediation effect testing procedure, the testing is terminated. Self-efficacy fully mediates the relationship between effort expectation and scientific research information literacy, i.e., effort expectation influences teachers' scientific research information literacy through self-efficacy.

Table 9: Strive to be relevant to scientific information literacy

	Path name	Estimate	P
C1	Scientific information literacy←←Effort expectation	0.541	0.003
A1	Self-efficacy←←Effort expectation	0.622	0.005
B1	Scientific information literacy←←Self-efficacy	0.348	0.007
C'1	Scientific information literacy←←Effort expectation	0.322	0.122

Table 10 shows the correlations among the variables in the structural model of effort expectation and professional information literacy. There is a significant positive correlation between effort expectation and professional information literacy, i.e., C is significant. There is a significant positive correlation between effort expectation and self-efficacy, i.e., A is significant. There is a significant positive correlation between self-efficacy and professional information literacy, i.e., B is significant. Proceed to the third step of the test. There is no significant positive correlation between self-efficacy and professional information literacy, i.e., C' is not significant. According to the mediation effect testing procedure, the test is terminated. Self-efficacy fully mediates the relationship between effort expectation and professional information literacy, i.e., effort expectation influences teachers' professional information literacy through self-efficacy.

Table 10: Try to expect a correlation between professional information literacy variables

	Path name	Estimate	P
C2	Professional information literacy←←Effort expectation	0.656	0.022
A2	Self-efficacy←←Effort expectation	0.555	***
B2	Professional information literacy←←Self-efficacy	0.608	0.018
C'2	Professional information literacy←←Effort expectation	0.005	0.999

Table 11 shows the correlations among the variables in the structural model of community influence on professional information literacy. There is a significant positive correlation between community influence and professional information literacy, i.e., C is significant. There is a significant positive correlation between community influence and self-efficacy, i.e., A is significant; there is a significant positive correlation between self-efficacy and professional information literacy, i.e., B is significant. Proceed to the third step of the test. There is no significant positive correlation between community influence and professional information literacy, i.e., C' is not significant. According to the mediation effect testing procedure, the testing is terminated. Self-efficacy fully mediates the relationship between community influence and professional information literacy, i.e., community influence affects professional information literacy through self-efficacy.

Table 11: Community impact on professional information literacy

	Path name	Estimate	P
C3	Professional information literacy←←Community impact	0.722	***
A3	Self-efficacy←←Community impact	0.749	***
B3	Professional information literacy←←Self-efficacy	0.456	***
C'3	Professional information literacy←←Community impact	0.789	0.058

Table 12 shows the correlations among the variables in the structural model of community influence on scientific information literacy. There is a significant positive correlation between community influence and scientific information literacy, i.e., C is significant. There is a significant positive correlation between community influence and self-efficacy, i.e., A is significant; there is a significant positive correlation between self-efficacy and scientific information literacy, i.e., B is significant. Proceed to the third step of the test. There is no significant positive correlation between community influence and scientific information literacy, i.e., C' is not significant. According to the mediation effect testing procedure, the testing is terminated. Self-efficacy fully mediates the relationship between community influence and scientific information literacy, i.e., community influence affects scientific information literacy through self-efficacy.

Table 12: Community impact on scientific information literacy

	Path name	Estimate	P
C4	Scientific information literacy←←Community impact	0.456	0.003
A4	Self-efficacy←←Community impact	0.588	***
B4	Scientific information literacy←←Self-efficacy	0.489	0.008
C’4	Scientific information literacy←←Community impact	0.175	0.222

Similarly, individual motivation plays a complete mediating role between community influence and basic information literacy, individual motivation plays a complete mediating role between community influence and professional information literacy, individual motivation has a significant mediating effect between convenience and basic information literacy, and individual motivation has a significant mediating effect between convenience and professional information literacy.

IV. D. Three dimensions of improving teachers' information literacy

IV. D. 1) Value Dimension

Teachers are the main force and implementers of talent cultivation in schools. In the era of Education Informatization 2.0, it can be said that teachers' information literacy levels directly impact the quality of education, teaching, and talent cultivation. Amid the tide of education informatization, enhancing teachers' information literacy has become a fundamental need for university teachers to break through growth bottlenecks and achieve development, primarily manifested in three aspects. First, from an adaptive perspective, it is an intrinsic requirement for teachers to adapt to educational reforms. Second, from a developmental perspective, it is a necessary condition for teachers' lifelong learning and development. Third, from a process-oriented perspective, it is the key to enhancing teachers' educational and teaching standards.

IV. D. 2) Practical dimension

At the policy guidance level, institutional innovation can fully stimulate new momentum for improving teachers' information literacy, which plays an important role in promoting the internal development and high-quality development of universities. At the teacher training level, tiered training can fully tap into teachers' information literacy, which plays an important role in promoting educational and teaching reforms in universities, helping teachers to confidently address the challenges and impacts brought by the Education Informatization 2.0 era. In terms of resource support, improving the hardware and software environment for information-based education and teaching can inject new vitality into the enhancement of teachers' information literacy. This is crucial for universities to promote the deep integration of modern information technology with education and teaching, and it is a necessary condition for the enhancement of teachers' information literacy.

IV. D. 3) Innovation Dimension

The educational information ecosystem is a self-regulating and self-purifying system that is composed of the modern information technology environment, teachers and students, and education and teaching practices in a specific educational environment. It is of great significance to innovate and build an ecological circulation system for improving the information literacy of college teachers and return to the standard of education informatization 2.0. The ecological circulation system of improving the information literacy of college teachers can be used as a metaphor for the "big tree" with deep roots and leaves, and the teaching process of teacher education and student learning (the center of "teaching and learning") can be regarded as a thick and straight "trunk". The new path of teachers' information literacy improvement is regarded as a "nutrient solution", which provides a steady stream of nutrients for the growth of large trees and forms a nutrient-rich "root" part. Schools, teachers, and students are seen as the "canopy" of leafy branches, participants and beneficiaries of the ecosystem.

V. Conclusion

Based on the calculation of various variables related to teachers' information literacy in the construction of university faculty teams, the construction of a model to explain the mechanisms influencing teachers' information literacy, empirical analysis, and predictions regarding teachers' information literacy in the construction of university faculty teams, the following conclusions were drawn.

Factors such as effort expectations, community influence, convenience conditions, anxiety, self-efficacy, and individual motivation all have a significant impact on the development of teachers' information literacy in university faculty development. Among these, anxiety has the strongest positive impact on basic information literacy and professional information literacy (0.591 and 0.545, respectively).

Additionally, data analysis revealed that individual motivation fully mediates the relationship between community influence and basic information literacy, fully mediates the relationship between community influence and professional information literacy, significantly mediates the relationship between convenience and basic information literacy, and significantly mediates the relationship between convenience and professional information literacy. Self-efficacy fully mediates the relationship between effort expectations and research information literacy, fully mediates the relationship between effort expectations and professional information literacy, fully mediates the relationship between social influence and professional information literacy, and fully mediates the relationship between social influence and research information literacy.

In summary, improving teachers' information literacy cannot be achieved overnight; it is a systematic project that requires long-term, persistent, and gradual efforts. Teachers themselves must transition from being “followers” of information-based education and teaching to becoming “innovators, exemplars, and leaders” in this field. At the institutional level, schools must strengthen top-level design, reinforce overall planning, and persistently advance the systematic improvement of teachers' information literacy.

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