



# Construction and Empirical Validation of an Evaluation Index System for University Students' Digital Literacy in the New Media Era

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**Abstract.** This study develops a comprehensive evaluation index system for assessing university students' digital literacy in the new media era. The system comprises 4 primary, 11 secondary, and 34 tertiary indicators. Using data from questionnaire surveys, the research confirms the system's strong reliability and validity. The findings offer a practical tool for measuring digital literacy and provide actionable recommendations for improving digital competencies among students, benefiting educators and policymakers.

**Keywords:** Digital Literacy; New Media; University Students; Evaluation Index System; Empirical Research.

## 1 Introduction

With the widespread adoption of 5G and rapid evolution of internet platforms, new media plays a central role in university students' academic and personal lives. While benefiting from the internet's accessibility, students face challenges like information overload and cybersecurity risks [1, 2]. In this context, digital literacy has become essential for students to succeed [3].

However, China lacks a standardized system for evaluating university students' digital literacy, making it difficult to assess and improve their competencies [4]. This study aims to develop and validate an evaluation index system for digital literacy, providing a scientific tool for educators and policymakers to better understand and enhance students' digital skills. The findings contribute to both academic research and practical approaches to digital literacy education in Chinese universities.

## 2 Methods

### 2.1 Generation of the Index System

In the new media era, university students' digital literacy has become increasingly important. To systematically assess this, the study conducted a comprehensive literature review of domestic and international research on digital literacy evaluation [5, 6].

The research team constructed an index system by integrating indicators from relevant studies and policies, removing redundancies, and merging similar elements [7]. Feedback from 14 digital literacy experts and 6 university IT instructors was incorporated to refine the indicators.

The final evaluation system consists of four primary indicators—internet cognition and application, internet norms and security, internet identification and innovation, and internet behavior and restraint—further divided into 11 secondary and 34 tertiary indicators (Table 1).

**Table 1.** Evaluation Index System for University Students' Digital Literacy in the New Media Era

Primary Indicators	Secondary Indicators	Tertiary Indicators
Internet Cognition and Application (Q1)	Internet Cognition Literacy (S1)	Basic Internet Knowledge (T1)
		Internet Value Recognition (T2) Understanding Characteristics of Internet Communication (T3)
	Internet Application and Communication (S4)	Accessing Information Through Multiple Channels (T12)
		Online Communication and Collaboration (T13) Mastering Common Internet Tools (T14)
Internet Norms and Security (Q2)	Internet Security Norms (S2)	Assessing Online Environment (T4)
		Personal Information Protection (T5)
		Safeguarding Cybersecurity (T6)
	Internet Legal Norms (S6)	Internet Law Classroom Knowledge Education (T18)
		Internet Law Classroom Practical Education (T19) Promoting Legal Culture on Campus (T20)
		Enhancing Awareness of Internet Legal Education (T21)
Internet Ethical Norms (S10)	Internet Awareness and Attitude (T29)	
	Understanding Online Public Opinion (T30)	

Internet Identification and Innovation (Q3)	Internet Information Identification (S3)	Organizing and Integrating Information (T7) Information Processing and Critical Thinking (T8) Creating and Disseminating Information (T9) Identifying Information Authenticity (T10) Methods of Acquiring Internet Information (T11)
	Internet Innovation Literacy (S8)	Internet Design and Practice (T25) Information Retrieval and Identification (T26)
Internet Behavior and Restraint (Q4)	Internet Usage Behavior (S5)	Online Entertainment (T15) Online Learning Behavior (T16) Online Part-Time Work (T17)
	Self-Improvement in Cyberspace (S7)	Independent Thinking (T22) Interaction in Virtual Communities (T23) Understanding Future Trends in Cyberspace (T24)
	Internet Consumption Management (S9)	Understanding Consumer Rights (T27) Promoting Green and Sustainable Consumption (T28)
	Internet Self-Restraint (S11)	Managing Internet Time (T31) Managing Internet Applications (T32) Managing Online Emotions (T33) Regulating Online Speech (T34)

## 2.2 Data Collection and Survey Design

To assess university students' digital literacy in the new media era and validate the preliminary evaluation index system, a questionnaire survey was conducted. The questionnaire was designed using widely accepted scales from domestic studies, with adjustments to reflect the unique aspects of students' digital literacy.

The survey had two sections: demographic data (gender, grade, academic discipline, and university) and digital literacy assessment based on 11 primary and 34 secondary indicators. Responses were measured on a five-point Likert scale from 'Strongly Agree' to 'Strongly Disagree.'

Data collection occurred in two phases. The preliminary survey, conducted online via Wenjuanxing on January 29, 2024, involved universities in the research team's city

and yielded 423 valid responses (91.16% response rate). The formal survey, conducted at 12 universities across Shandong Province, collected 373 valid responses from 412 distributed questionnaires (90.53% response rate). Both datasets were well-represented across key demographics, ensuring a solid foundation for analysis.

### 3 Results

To evaluate the scale's internal consistency, Cronbach's  $\alpha$  was calculated. All primary indicators exceeded 0.7, indicating acceptable reliability, while the total scale achieved an impressive  $\alpha$  of 0.966, reflecting excellent overall reliability.

Structural validity was confirmed by the KMO test and Bartlett's test of sphericity, with a KMO value of 0.965 and a significant Bartlett's test result ( $p < 0.001$ ), validating the data for factor analysis.

Principal component analysis was conducted to extract common factors, selecting components with eigenvalues greater than 1. The maximum variance method was applied to rotate the original loadings, with results presented in Table 2, and the rotated component matrix provided in Table 3.

As shown in Table 2, four common factors with eigenvalues greater than 1 were extracted, which cumulatively accounted for 67.571% of the total variance. This relatively high explanatory power suggests that these four common factors effectively encapsulate the information contained within the 34 indicators assessing digital literacy among university students.

**Table 2.** Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sum of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	16.682	49.065	49.065	16.682	49.065	49.065	9.087	26.727	26.727
2	2.999	8.820	57.886	2.999	8.820	57.886	6.943	20.421	47.148
3	1.930	5.676	63.561	1.930	5.676	63.561	4.071	11.973	59.121
4	1.363	4.009	67.571	1.363	4.009	67.571	2.873	8.450	67.571
5	0.837	2.461	70.031						
6	0.816	2.399	72.430						
...	...	...	...						
32	0.128	0.376	99.310						
33	0.125	0.367	99.677						
34	0.110	0.323	100.000						

The rotated component matrix (Table 3) indicated that all item loadings exceeded 0.5, fulfilling the retention criteria. Consequently, the original primary indicators were consolidated into four common factors: "Internet Cognition and Application," "Internet Norms and Security," "Internet Identification and Innovation," and "Internet Behavior and Restraint." This optimization reduces subjectivity in classification, reinforcing the scientific foundation of the evaluation index system.

**Table 3.** Rotated Component Matrix

	Component					Component			
	1	2	3	4		1	2	3	4
T <sub>1</sub>			0.553		T <sub>18</sub>		0.676		
T <sub>2</sub>			0.508		T <sub>19</sub>		0.642		
T <sub>3</sub>			0.804		T <sub>20</sub>		0.523		
T <sub>4</sub>		0.691			T <sub>21</sub>		0.544		
T <sub>5</sub>		0.672			T <sub>22</sub>	0.746			
T <sub>6</sub>		0.59			T <sub>23</sub>	0.634			
T <sub>7</sub>				0.748	T <sub>24</sub>	0.581			
T <sub>8</sub>				0.57	T <sub>25</sub>				0.655
T <sub>9</sub>				0.519	T <sub>26</sub>				0.546
T <sub>10</sub>				0.567	T <sub>27</sub>	0.718			
T <sub>11</sub>				0.646	T <sub>28</sub>	0.506			
T <sub>12</sub>			0.581		T <sub>29</sub>		0.674		
T <sub>13</sub>			0.519		T <sub>30</sub>		0.628		
T <sub>14</sub>			0.64		T <sub>31</sub>	0.708			
T <sub>15</sub>	0.754				T <sub>32</sub>	0.632			
T <sub>16</sub>	0.58				T <sub>33</sub>	0.577			
T <sub>17</sub>	0.604				T <sub>34</sub>	0.678			

## 4 Conclusions

This study developed and validated a comprehensive evaluation index system for assessing university students' digital literacy in the new media era. The final system includes four primary indicators, eleven secondary indicators, and thirty-four tertiary indicators. Principal component analysis confirmed the system's scientific rigor and effectiveness.

The four main factors—"Internet Cognition and Application," "Internet Norms and Security," "Internet Identification and Innovation," and "Internet Behavior and Restraint"—capture the essential dimensions of digital literacy for university students to-

day. The scale demonstrated high reliability and validity, with a Cronbach's  $\alpha$  coefficient of 0.966, confirming its consistency and structural soundness. This provides a strong foundation for future research and practical application in digital literacy education.

## Acknowledgment

This research is supported by the 2024 National Innovation and Entrepreneurship Training Program for College Students: 'Construction and Empirical Analysis of an Evaluation Index System for University Students' Digital Literacy in the New Media Era—Based on a Survey of 12 Universities in Shandong Province' (Project No.: 202411688033).

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