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Research on the Construction Method of Digital Literacy Evaluation System for University Teachers Based on AI-TPACK

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A**bstract:** This study, grounded in the AI-TPACK theory framework, focuses on university teachers as research subjects and aims to develop a scientific and practical evaluation system for digital literacy. Through literature review, Delphi method, and analytic hierarchy process (AHP), we systematically examine the theoretical connections between AI-TPACK and digital literacy, identifying core components of faculty digital competence. After multiple rounds of expert consultations, the research team established evaluation metrics aligned with academic practices, assigned weightings to each indicator, and ultimately developed a multidimensional assessment system encompassing technological, pedagogical, content, and AI integration dimensions. This system effectively addresses the limitations of traditional evaluation methods, providing theoretical foundations and practical references for precise assessment and targeted enhancement of faculty digital literacy. The results demonstrate that the developed system exhibits strong reliability and validity, meeting current demands for evaluating teacher competencies in the context of digital transformation in higher education.
Keywords: AI-TPACK; University teachers; Digital literacy; Assessment system; Construction method

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1. Introduction

The deep integration of digital technology and AI has propelled higher education into a critical phase of digital and intelligent transformation. As the core platforms for talent cultivation and academic research, universities now demand higher-level digital and intelligent literacy from their faculty. The digital and intelligent literacy of university teachers directly determines the quality of technology-integrated classroom instruction and impacts the core outcomes of talent development. Therefore, establishing a scientific and rational evaluation system for digital and intelligent literacy has become a crucial task in higher education reform. Existing research on digital and intelligent literacy assessment often focuses on single dimensions, some emphasize technical application capabilities, while others concentrate on teaching competency alignment, lacking systematic consideration of the deep integration of technology, pedagogy, content, and AI. The AI-TPACK theory, as an extension of traditional TPACK, incorporates AI technology into its core framework, forming

a multidimensional system comprising technical knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), pedagogical content knowledge (PCK), technical pedagogical knowledge (TPK), technical content knowledge (TCK), and AI integration knowledge (AIK). This provides comprehensive theoretical support for evaluating university teachers 'digital and intelligent literacy [1]. Grounded in the AI-TPACK theoretical framework and practical teaching scenarios, this study explores methods for constructing an evaluation system to address existing research gaps. The research aims to resolve issues such as ambiguous evaluation standards and single-method approaches for assessing university teachers' digital and intelligent literacy, offering actionable guidance for developing teacher training programs and optimizing faculty development strategies. This effort will facilitate the orderly advancement of digital and intelligent transformation in higher education.

2. Core concept definition

2.1. AI-Tpack theory

The AI-TPACK theory is a novel pedagogical knowledge framework developed by integrating AI elements into traditional TPACK theory. Researchers have established AIK as a core dimension, which is deeply integrated with traditional TK, PK, and CK to form seven interconnected knowledge modules.

TK refers to the ability of university teachers to apply digital and intelligent tools, including operating and utilizing AI teaching platforms, big data analytics tools, and online teaching systems. PK denotes their professional competencies in instructional design, classroom management, and student learning analysis. CK represents their profound understanding and precise mastery of subject-specific knowledge in their teaching disciplines [2].

AIK specifically denotes the competencies of university faculty in applying artificial intelligence technologies to optimize teaching workflows, innovate instructional models, and enhance pedagogical outcomes. This encompasses both theoretical knowledge and practical skills in AI-assisted instructional design, AI-powered learning diagnostics, and AI-driven personalized teaching resource delivery. The AI-TPACK theory emphasizes the synergistic interaction among knowledge modules, providing a comprehensive theoretical framework for systematically evaluating the digital literacy of university educators [3].

2.2. Digital literacy of university teachers

The digital literacy of university teachers refers to their comprehensive ability to utilize artificial intelligence technologies, digital tools, and professional teaching skills in a digitalized teaching environment. This ability enables them to accomplish teaching tasks, enhance teaching quality, and promote students' all-round development. It is not a single capability but a composite literacy encompassing knowledge, skills, and attitudes.

In terms of knowledge, university teachers should master foundational knowledge of digital and intelligent technologies, disciplinary expertise, and AI-TPACK theory to build a comprehensive knowledge system. Regarding skills, they must acquire proficiency in operating digital tools, utilizing AI-assisted teaching, developing digital teaching resources, and conducting student learning analysis. At the attitude level, educators should embrace the concept of digital and intelligent teaching, actively adopt new teaching technologies, and maintain a mindset and willingness for continuous learning in these fields [4].

The core characteristics of digital literacy of university teachers are comprehensiveness, practicality and dynamism. The development level of digital literacy is closely related to the process of digital transformation of higher education, and it is the core index to measure the adaptation of university teachers to the needs of digital teaching.

3. Principles for constructing an AI-Tpack-Based digital literacy assessment system for university teachers

3.1. Principle of scientificity

The evaluation system should be built on the AI-TPACK theory as its core foundation. This study must ensure that the assessment indicators align with the core principles of digital literacy, with clear definitions and logical coherence, while avoiding redundancy or omissions. The selection of evaluation methods should be tailored to the characteristics of the research subjects, combining quantitative and qualitative approaches to ensure the objectivity and accuracy of the results. Additionally, the evaluation system should accommodate the varying levels of digital literacy among teachers across different disciplines and with varying years of teaching experience in higher education institutions, avoiding a one-size-fits-all approach.

3.2. Principle of practicality

The evaluation system must demonstrate strong practical applicability, with assessment indicators being concise, clear, and quantifiable to avoid abstract or vague formulations. This study requires ensuring that all evaluation metrics can be measured through concrete methods, with a streamlined process suitable for routine assessments by university HR and academic affairs departments. Moreover, the evaluation tools should prioritize user-friendliness, integrating with digital platforms to enhance operational efficiency [5].

3.3. Systematic principle

The digital literacy of university faculty constitutes a multifaceted competency system. The evaluation framework must encompass all core dimensions of digital literacy to establish a comprehensive assessment structure. This study requires ensuring interrelated and complementary dimensions that highlight the essential elements of the AI-TPACK theory while addressing practical teaching needs, thereby holistically reflecting faculty's digital literacy proficiency. Furthermore, the evaluation system should account for evolving digital technologies, reserve flexibility for metric adjustments, and guarantee long-term sustainability [6].

3.4. Guiding principle

The evaluation system should not only assess performance but also guide the development of digital literacy among university faculty. When establishing evaluation criteria, this study emphasizes the core integration of digital technologies with teaching practices, encouraging educators to proactively enhance their AI application skills and digital teaching innovation capabilities. Furthermore, the assessment outcomes should provide precise references for universities to design faculty training programs and optimize teaching staff development strategies, thereby promoting the comprehensive improvement of digital literacy among academic personnel.

4. Construction process of digital literacy evaluation system for college teachers based on AI-Tpack

4.1. Primary screening evaluation criteria

Building upon the AI-TPACK theoretical framework and integrating the core components of digital literacy for university educators, this study systematically analyzed existing research through literature review. The research team conducted a comprehensive review of key domestic and international publications on TPACK theory, digital literacy assessment, and AI-based teaching applications. They identified frequently occurring evaluation metrics and established an initial assessment framework comprising 7 primary indicators and 22 secondary indicators.

The primary indicators correspond to the seven knowledge modules of the AI-TPACK theory: TK, PK, CK, PCK, TPK, TCK, and AIK. Secondary indicators are defined based on the core concepts of each primary indicator. For example,

the secondary indicators corresponding to TK include digital-intelligent tool operation skills, foundational knowledge of digital-intelligent technologies, and troubleshooting capabilities for digital-intelligent tools [7].

To ensure the compatibility of the indicators, this study assembled an expert panel comprising 5 higher education pedagogy specialists, 3 AI technology application experts, and 2 academic administration leaders. The panel conducted the first round of consultations on the preliminary indicator pool. Based on practical teaching experiences in higher education institutions, the experts proposed adjustments to the indicators. Following these recommendations, the study removed 3 redundant indicators and refined the descriptions of 5 others, ultimately establishing a preliminary evaluation system with 7 primary indicators and 19 secondary indicators.

4.2. Optimization of evaluation indicators and weight determination

This study employed the Delphi method to conduct multiple rounds of optimization on the preliminary evaluation indicator system, determining the weight distribution of each indicator. We designed an expert consultation questionnaire, which included two parts: the importance rating of indicators and suggestions on the rationality of indicator connotations. The importance rating used a 5-point Likert scale, where 1 to 5 points corresponded to "extremely unimportant," "unimportant," "neutral," "important," and "extremely important," respectively.

This study distributed the first-round consultation questionnaire to 15 experts, with 15 valid responses collected, achieving a 100% response rate. The research team utilized SPSS 26.0 statistical software to conduct reliability and validity analyses. The results demonstrated a Cronbach's alpha coefficient of 0.89 and a KMO value of 0.82, indicating strong reliability and validity. Based on expert evaluations, two secondary indicators with scores below 3.5 were removed, and the conceptual descriptions of three indicators were refined to develop the second-round consultation questionnaire.

After distributing the second round of consultation questionnaires, 14 valid responses were collected, achieving a 93.3% response rate. Experts demonstrated significantly enhanced agreement on the indicators, with all metrics scoring above 3.8 in importance and reaching consensus. The study employed the analytic hierarchy process (AHP) to determine indicator weights. Through constructing a judgment matrix, calculating eigenvalues and eigenvectors, and performing consistency checks, the final weights for both primary and secondary indicators were established.

The weight analysis reveals that AIK carries the highest weight at 0.22, followed by TPK at 0.18. Other key components include PCK at 0.16, TK at 0.14, CK at 0.12, PK at 0.09, and TCK at 0.09. This weight distribution underscores the pivotal role of AI technology integration in education, aligning with the core competency requirements for teachers in the digital and intelligent transformation of higher education [8].

4.3. Validation of the evaluation system

This study conducted empirical validation of the developed evaluation system by selecting 50 teachers from a local university, representing diverse academic disciplines and teaching experience levels. The research team employed a combined approach of questionnaire surveys and classroom observations to collect data on the teachers' digital literacy. The questionnaire survey utilized an optimized evaluation framework to design targeted questionnaires, distributing 50 copies and receiving 48 valid responses. For classroom observations, a panel of three evaluation experts conducted on-site assessments and scoring of the teachers' digitalized classroom instruction practices.

This study employed SPSS 26.0 statistical software to conduct reliability and validity testing on the collected evaluation data. The reliability analysis demonstrated a Cronbach's alpha coefficient of 0.91, indicating strong internal consistency within the evaluation system. The validity analysis revealed that all secondary indicators showed correlation coefficients exceeding 0.7 with their corresponding primary indicators, with all results statistically significant ($P < 0.05$), confirming robust structural validity. Furthermore, comparative analysis between the evaluation results and the digital-intelligent teaching achievements of sampled teachers revealed a significant positive correlation ($r = 0.78$, $P < 0.01$), further validating the effectiveness of the evaluation system.

5. Content of the digital literacy assessment system for university teachers based on AI-TPACK

5.1. Composition of primary and secondary indicators

Based on the established framework, the final assessment system for digital literacy among university faculty comprises 7 primary indicators and 17 secondary indicators, with their corresponding weights detailed below. The core definitions of each primary indicator and the secondary indicators are outlined as follows:

(1) TK (weight 0.14): This core indicator assesses university faculty's proficiency in digital-intelligent technology tools, with four sub-indicators: foundational knowledge of digital-intelligent technologies, operational skills for digital-intelligent teaching tools, troubleshooting capabilities for digital-intelligent tools, and real-time tracking of digital-intelligent technology developments;

(2) PK (weight 0.09): This core indicator reflects the professional teaching competence of university faculty, with four sub-indicators: instructional design capability, classroom management and regulation ability, learning situation analysis capability, and teaching evaluation capability;

(3) CK (weight 0.12): This core metric evaluates university faculty's mastery of disciplinary expertise, with three sub-indicators: deep understanding of core disciplinary knowledge, ability to construct disciplinary knowledge systems, and reserve of cutting-edge disciplinary knowledge;

(4) PCK (weighting 0.16): This core indicator assesses university teachers' ability to integrate disciplinary knowledge with teaching methodologies. The secondary indicators include two components: the capacity to translate disciplinary knowledge into teaching practice, and the ability to design targeted teaching strategies;

(5) TPK (weighting 0.18): This core indicator assesses university faculty's ability to integrate digital-intelligent technologies with teaching methodologies, with two sub-indicators: digital-intelligent technology adaptation capability and innovation capability in digital teaching models;

(6) TCK (weight 0.09): This core indicator assesses university faculty's ability to integrate digital and intelligent technologies with disciplinary content, with its secondary indicator specifically measuring the capability to use such technologies to enhance subject knowledge delivery;

(7) AIK (weight 0.22): This core metric evaluates university faculty's ability to leverage AI technologies for teaching optimization, with two sub-indicators: AI-assisted instructional design and AI-powered learning diagnostics with personalized teaching.

5.2. Setting evaluation criteria

Based on the connotation and weight of each index, this study establishes a grading evaluation standard, categorizing the digital literacy level of university teachers into four grades: excellent, good, qualified, and unqualified, with corresponding score ranges of 85 points and above, 70–84 points, 60–69 points, and below 60 points respectively.

The core evaluation criteria for each competency level are as follows:

(1) Excellent-level teachers must demonstrate mastery of all dimensions of digital literacy, skillfully apply AI technologies and digital tools to innovate teaching methods, and produce distinctive digitalized teaching outcomes;

(2) Good-level teachers should demonstrate proficiency in all dimensions of digital literacy, effectively utilize AI technologies and digital tools to support instruction, and achieve notable teaching effectiveness;

(3) Qualified teachers must possess basic mastery of core digital literacy competencies, be able to employ fundamental digital tools in teaching, and meet the basic requirements of digitalized education;

(4) Unqualified teachers lack core digital literacy competencies and are unable to effectively utilize digital technologies in teaching.

6. Conclusion and prospects

6.1. Research conclusions

Based on the AI-TPACK theory, this paper constructs a scientific and feasible evaluation system for university teachers' digital literacy through literature review, Delphi method, AHP, and empirical verification. The system comprises 7 primary indicators and 17 secondary indicators, with clearly defined weights and evaluation criteria, demonstrating strong reliability and validity.

The research findings demonstrate that AIK constitutes the core dimension of digital literacy for university teachers, holding the highest weight. This outcome aligns with the essential requirements of digital transformation in higher education, underscoring the critical importance of integrating artificial intelligence technology with teaching practices. Meanwhile, the elevated weights of TPK and subject PCK indicate that deep integration of digital technologies with teaching methodologies and disciplinary content represents a pivotal direction for enhancing faculty digital literacy. The developed evaluation framework addresses gaps in existing research by systematically incorporating AI-TPACK theory while adapting to real-world teaching scenarios. This system provides an effective tool for precise assessment of faculty digital literacy, offering actionable insights for advancing the digital transformation of academic institutions.

6.2. Research perspectives

While the evaluation framework developed in this study has been empirically validated, it still has certain limitations. The research sample was limited to the teachers at a single regional university, resulting in a narrow coverage. Future studies could expand the sample to include educators from universities at different levels and across various regions, thereby further validating the system's general applicability. Additionally, given the rapid advancement of digital and intelligent technologies, with artificial intelligence applications in higher education continuously expanding, this research should incorporate technological developments to periodically adjust evaluation metrics and their weighting. This approach would ensure the system remains timely and forward-looking.

Furthermore, future research could integrate evaluation frameworks to develop digital assessment platforms, automating and enhancing the intelligence of evaluation processes to boost efficiency and accuracy. At the same time, tailored pathways for improving digital literacy could be established based on evaluation results, creating a closed-loop, mechanism of "evaluation-feedback-improvement" to drive comprehensive enhancement of digital literacy among university teachers. This would provide stronger faculty support for the digital transformation of higher education.

Disclosure statement

The author declares no conflict of interest.

References

[1] You Y, 2025, Research on the Pathways of Empowering Local Excellent Culture to Integrate into University Ideological and Political Education Through Digital Intelligence Technology. *Popular Arts*, 2025(23): 154–156.

[2] Wang L, 2025, The "Dilemma" and "Breakthrough" in Enhancing the Digital and Intelligent Literacy of University Teachers from the Perspective of Artificial Intelligence. *China Journal of Multimedia and Network Teaching (First Ten)*, 2025(11): 115–118.

[3] Zhao Y, 2025, Enhancing Digital Literacy of Ideological and Political Course Teachers in the Digital Age: Values, Challenges, and Pathways. *Beijing Education (Moral Education)*, 2025(10): 50–56.

[4] Li X, 2025, Strategies for Enhancing Digital Literacy of Private University Teachers in the Digital Intelligence Era. *Journal of Yellow River Science and Technology University*, 27(10): 28–34.

[5] Zeng F, Zhang P, 2025, The Intrinsic Logic, Practical Constraints, and Development Pathways of Digital Literacy for University Physical Education Teachers in the Digital Intelligence Era. *Journal of Nanjing Institute of Physical Education*, 24(9): 52–57.

[6] Qi J, Wu B, 2025, Digital Empowerment and Disciplinary Adaptation: Reconstructing the Path to Enhance Digital Literacy of Foreign Language Teachers in Higher Education. *China Information Technology Education*, 2025(18): 105–108.

[7] Yang S, Yu Y, 2025, Research on the Pathways for Enhancing Digital Literacy of Ideological and Political Course Teachers in the Digital Age. *Reform and Opening-up*, 2025(17): 98–104.

[8] Mei B, 2025, Enhancing the Competence of University Teachers Under the Guidance of Educators' Spirit in the Digital and Intelligent Era. *China Higher Education*, 2025(17): 16–21.