World Journal of Innovation and Modern Technology, Vol. 8, Issue 11 (Nov) 2025
ISSN 2682-5910
DOI: 10.53469/wjimt.2025.08(11).04

Development of University Teacher AI Competence Self-efficacy (TAICS) Scale in China's Border Ethnic Regions

Chu Tan

College of International Studies, Honghe University, Mengzi, China

Abstract: ***AI holds substantial and profound implications for teaching and learning, as well as for the enhancement of teachers' roles and capabilities. The integration of AI in educational contexts demonstrates considerable potential to enable innovative approaches to instruction, learning, and administration, while also improving learning experiences and facilitating teachers' professional responsibilities. As AI continues to transform modes of production, daily life, and educational practices, it is steering human society into a new developmental phase (Zhu & He, 2012).This research employs the Delphi method and integrates the "AI Competency Framework for Teachers" (AI CFT; Miao, 2024) with the Teacher AI Competence Self-efficacy (TAICS) scale, initially explored by Thomas et al. (2024) in their study on teacher competency self-efficacy. Grounded in Thomas's scale and Bandura's self-efficacy theory, the present study aims to develop a scale for assessing Teacher AI Competence Self-efficacy (TAICS) among university faculty. The scale design process will incorporate the perspectives of educators and account for the specific contextual factors of AI-mediated teaching and learning within higher education institutions in China's border ethnic regions.***

Keywords: Teacher AI competence self-efficacy (TAICS); AI competence framework for teachers (AI CFT); Framework development.

1. INTRODUCTION

Artificial Intelligence (AI) processes extensive datasets, generates novel content, and facilitates decision-making through predictive analytics. In the educational domain, AI has reconfigured the conventional teacher–student relationship into a triadic structure involving the teacher, AI, and student. This transformation necessitates a critical re-evaluation of teachers' roles and the competencies required in the age of AI. Nevertheless, few countries have formally defined these competencies or established national initiatives to equip educators with AI-related skills, resulting in a widespread lack of guidance for practitioners. By 2022, only seven countries had developed specific AI frameworks or training programmes for teachers. While this shift represents a significant evolution in education, it also introduces unprecedented challenges and imposes increasingly complex demands on teachers' professional growth. These developments contribute to considerable pressure on educators, who are expected to continuously update their knowledge and skills while mastering new tools and methodologies to navigate rapid and intricate changes in the educational landscape. Amid heavy teaching loads and administrative responsibilities, many teachers—particularly younger educators—report feelings of being overwhelmed and disoriented (Yang, 2023). In response to the need for educational systems to adapt to contemporary technological advances, the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2024) has published the "AI Competency Framework for Teachers" (Miao, 2024).

This study proposes the development of an AI Competency Self-Efficacy Scale for university teachers in minority regions of China. Grounded in the UNESCO CFT framework and informed by existing student-focused instruments such as the Student AI Competency Self-Efficacy (SAICS) scale (Thomas et al., 2024), the proposed University Teacher AI Competency Self-Efficacy (TAICS) scale is designed to incorporate the unique socio-cultural and educational context of border regions. The resulting instrument is expected to provide researchers with a validated tool for evaluating the effectiveness of interventions aimed at enhancing teacher AI competencies. It will also support teachers in self-assessing their ability to integrate AI into instructional practice. Furthermore, the findings may assist policymakers in formulating national standards for AI competency in higher education. Overall, this study seeks to advance understanding of the core components of AI competency among university teachers in China's minority regions.

2. LITERATURE REVIEW

2.1 The Key Principle of AI in Education

The AI Competency Framework for Teachers (AI CFT) is underpinned by six foundational principles designed to guide the ethical and effective integration of artificial intelligence in educational contexts. These principles are as follows: (1) fostering an inclusive digital future; (2) adopting a human-centered approach to AI; (3) safeguarding teachers' rights while redefining their professional roles; (4) advancing trustworthy and environmentally sustainable AI systems in education; (5) ensuring universal applicability for educators alongside responsiveness to ongoing digital evolution; and (6) supporting lifelong professional learning. Central to this framework is the principle of a human-centered approach, which emphasizes the empowerment of educators through human-accountable AI utilization. Within this paradigm, teachers retain ultimate accountability for instructional and pedagogical decisions, with AI serving as a supportive tool rather than an autonomous agent. This principle also affirms the right of individuals to seek explainability from AI systems, necessitating that educators comprehend the rationale behind AI-generated conclusions and critically evaluate the accuracy, validity, and contextual relevance of AI outputs. Moreover, it underscores the importance of maintaining human oversight over AI's influence, ensuring that its application in educational settings remains aligned with pedagogical goals and human values.

Teachers must cultivate a critical understanding of the design intentions underlying AI tools and mitigate potential adverse effects on student learning and well-being. Furthermore, the principle of fostering an inclusive digital future necessitates that AI applications adhere to shared values, including non-discrimination, sustainability, and inclusion. Simultaneously, the principle of safeguarding teachers' rights emphasizes the need to protect educators' interests and redefine their professional roles within AI-integrated educational environments. To ensure substantive implementation, this principle delineates specific competencies that empower teachers to maintain oversight of AI technologies and preserve their professional autonomy.

Additionally, the principle of trustworthy and sustainable AI advocates for the adoption of systems that are reliable, transparent, environmentally sustainable, and aligned with core educational objectives aimed at promoting holistic human development. These foundational principles collectively underscore a commitment to the ethical, inclusive, and rights-based integration of AI in education, consistent with the goals of sustainable development. Educators are thus positioned to facilitate the responsible and effective application of AI in pedagogical contexts. By upholding these principles, frontline teachers can not only enhance instructional and learning outcomes but also contribute to the cultivation of a more equitable and sustainable educational ecosystem (UNESCO, 2024).

2.2 AI Competence Framework for Teachers

UNESCO announced the AI Competency Framework for Teachers (AI CFT) in 2024. The framework builds on UNESCO's past work, including the ICT Competency Framework for Teachers, Recommendation on the Ethics of Artificial Intelligence, AI and education: guidance for policy-makers, and more recent Guidance for Generative AI in education and research. The framework established the fundamental ideas, beliefs, knowledge, and critical skills that teachers must develop in order to comprehend the role of AI in education and use it to improve teaching and learning methods in an ethical, effective, safe, and responsible manner. The framework highlighted "human-centered" principles and prioritized the protection of human agency, accountability, and determination. Guided by the core principles of safeguarding teachers' rights, advancing human agency, and fostering sustainable development, the framework articulated a set of 15 competency blocks organized into five key aspects: a human-centered mindset, AI ethics, AI foundations and applications, AI pedagogy, and AI for professional learning. Furthermore, it proposed a three-tiered progression model—comprising the Acquire, Deepen, and Create levels—for the development of these teacher competencies. As a global reference, this tool guides the development of national AI competency frameworks, informs teacher training programmes, and helps in designing assessment parameters. It also provides strategies for teachers to build AI knowledge, apply ethical principles, and support their professional growth.

These competency frameworks emphasize the need to adhere to human-centered values in AI design and use, maintaining teachers' leading roles in teaching, and providing guidance for teachers' lifelong professional development. Nonetheless, the application of AI in education also entails risks, such as threatening human agency, infringing on data privacy, exacerbating educational inequities, and potentially creating new forms of discrimination. It could devalue the role of teachers, weaken teacher-student relationships, and possibly reduce investment in human capital development, thereby worsening the shortage of qualified teachers globally. Therefore, the application of AI in education requires careful consideration to ensure that teachers have the

necessary competencies and roles to use AI ethically and effectively.

2.3 The Measurement of Teacher AI Competence

Several instruments have been developed to measure teacher digital competence, which share conceptual affinities with AI-related competencies. For instance, Chiu, Falloon, et al. (2024) developed and validated scales for personal-ethical and personal-personal dimensions from Falloon's (2020) framework. Demeshkant et al. (2022) created an instrument combining TPACK and DigCompEdu items to evaluate digital competence among higher education teachers, while Schmidt et al. (2009) designed a TPACK survey. Although these tools are valuable in their original contexts, they are not specifically designed to assess the competencies needed to address AI-related educational challenges. Moreover, some instruments may be overly complex or contextually misaligned for K–12 teachers, having been initially developed for higher education or broad educational audiences. Consequently, there remains a need for the development and validation of tailored instruments that can reliably measure AI-related competencies specifically within K–12 teaching contexts.

2.4 Self-efficacy in Educational Contexts

Self-efficacy represents one of the most extensively examined constructs in educational research, with numerous studies underscoring its significance across diverse educational domains. The concept originates from Bandura's Social Learning Theory (1997), which emphasized the role of self-regulation in shaping human behavior. Bandura further asserted that an individual's beliefs and confidence in their own capabilities influence their willingness to attempt addressing challenges, as well as the manner in which they carry out actions. This perspective underscores that learning outcomes and performance levels are contingent upon one's belief in their own capacity. Bandura later formally defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments."

Empirical studies have consistently demonstrated the relevance of self-efficacy in educational contexts. For instance, Kozcu Çakır (2020) found that pre-service primary school teachers' self-efficacy beliefs in science teaching were positively correlated with learning strategies such as elaboration, metacognitive self-regulation, effort regulation, and time and study environment management. Similarly, research involving pre-service mathematics teachers indicated that their self-efficacy beliefs in mathematics negatively predicted mathematics anxiety, while self-efficacy in mathematics teaching negatively predicted teaching anxiety. Additionally, Vosough Matin (2023) identified a positive correlation between teaching self-efficacy and attitudes toward the teaching profession among special education teachers. Furthermore, a substantial body of literature supports the association between students' self-efficacy and their academic achievement.

In the context of research competence, O'Brien et al. (1998) developed the Research Attitudes Measure (RAM), a 23-item instrument focusing on motivation, conceptualization, analytical skills, ethical considerations, and dissemination (as cited in Forester et al., 2004). While this scale has been applied to students in specific disciplines, questions have been raised regarding its generalizability and practical utility across broader educational contexts.

3. METHODOLOGY

3.1 Research Instrument

This study used the Delphi method and TAICS scale, which is explored by Thomas (2024) et al., study on developing a teacher competence self-efficacy scale. In addition, guided by Thomas's scale and Bandura's theory of self-efficacy, this study will design a scale to assess the AI competence self-efficacy of university faculty. The design process will adopt the teachers' perspective and incorporate the specific contextual factors of AI teaching and learning in higher education institutions within China's border ethnic regions.

3.2 Delphi Study

A Delphi study is an established research methodology employed to derive a consensus among a panel of experts through iterative rounds of feedback. This approach encourages reflective deliberation, allowing participants to reconsider and refine their views in light of anonymized group responses (Barrett & Heale, 2020). To ensure panelist expertise, participants were selected based on two criteria: possession of a graduate or doctoral degree in computer science or engineering, and a minimum of three years of formal experience in teaching AI at the

university level.The Delphi procedure consisted of three rounds. The initial round involved distributing the preliminary list of items to the panelists for qualitative assessment regarding their relevance to AI teaching at the university level. Participants suggested modifications, including revisions, removals, combinations, and additions of items. Following each round, the research team synthesized the feedback to revise the item list; items undergoing substantial alteration were treated as new in subsequent rounds, while those meeting the 75% agreement threshold were finalized. In Rounds 2 and 3, panelists received the updated lists along with information on the agreement levels from the previous round and provided further feedback on the remaining items.

4. RESULTS AND DISCUSSION

Three Delphi rounds were completed by all the participants. Table 1 shows the final scale of TAICS integrated border region context. Six dimensions were revised and finalized from 8 dimensions.

Table 1: The final TAICS integrated border region context

Dimension	Item
Interdisciplinary Teaching with AI	• I can use AI to acquire cross-disciplinary knowledge (e.g., ethnic cultures, borderland ecology) and integrate it into instructional content. • I can use AI to design interdisciplinary inquiry projects (e.g., combining geography and economics to study regional development). • I can use AI to retrieve teaching resources beyond the standard curriculum, adapting them to local student needs.
Assessment with AI	• I can use AI to analyze student responses and adjust teaching strategies accordingly. • I can use AI to generate follow-up questions or exercises targeting knowledge gaps. • I can use AI to refine instructional designs (e.g., activity flows, assessment methods).
Multimedia Creation with AI	• I can use AI to create localized multimedia materials (e.g., visuals of ethnic traditions, micro-lectures) to support classroom teaching. • I can evaluate whether AI-generated media (e.g., historical simulations, science animations) are accurate and educationally appropriate.
Human-Centric and Ethical AI Use	• I can use AI to enhance rather than replace teacher-student interaction and personalized instruction. • I can ensure that AI-assisted content (e.g., lesson plans, case studies) reflects my teaching philosophy and avoids academic misconduct. • I can identify and address potential biases or inaccuracies in AI-generated content, guiding students to think critically.
Data Security and AI Evaluation	• I know how to protect student and personal data when using AI tools. • I can evaluate the applicability of AI-recommended resources (e.g., localized readings, exercises) to teaching objectives and student cognitive levels. • I can participate in developing or assessing simple AI teaching tools (e.g., automated grading systems).
Confidence and Adaptability with AI	• I feel confident using AI to support teaching in resource-limited or low-bandwidth environments. • I am willing to continuously explore and adapt new AI technologies to improve teaching in border region contexts.

The modification is highly effective and contextually sophisticated. It successfully transforms a generic, comprehensive AI competency scale into a focused, practical, and culturally-situated tool for teachers in China's border region universities. The revisions are not merely cosmetic; they represent a thoughtful adaptation that enhances the scale's relevance and applicability.

4.1 Enhanced Contextual Relevance and Localization

This is the most significant improvement. The modified scale moves from abstract examples to concrete, region-specific applications. Thomas et al., (2004)’s scale applied "science history, art theory", but refined as "ethnic cultures, borderland ecology". This immediately grounds the competencies in the local socio-geographic reality, making the scale feel directly applicable to the teachers' daily challenges and opportunities. It prompts educators to think about how AI can help them address their unique teaching context.

4.2 Improved Practicality and Actionability

The consolidation from eight dimensions to six streamlines the scale without losing core competencies. The merging of related domains (e.g., "Human-Centric Teaching" with "Data, Ethics, and AI") creates a more cohesive and less repetitive framework. The statements are more direct and focused on actionable outcomes.

4.3 Introduction of Critical New Competencies

The modified scale introduces a crucial, often overlooked skill for technologically developing regions: adaptive proficiency. “I feel confident using AI to support teaching in resource-limited or low-bandwidth environments.” This demonstrates a deep understanding of the real-world infrastructural challenges in border regions. It shifts the focus from merely "using AI" to "using AI effectively under constraints," which is a far more valuable and realistic competency.

4.4 Refined Ethical and Critical Thinking Focus

Ethics is not just a separate category but is woven into the practical domains. For instance, evaluating AI-generated media for accuracy and educational value is paired with its creation. The emphasis on identifying biases and guiding critical thinking is powerfully linked to the local context, where cultural representation is particularly sensitive.

4.5 Streamlined and Logical Structure

The new structure is more intuitive:

- Domain 1-3 (Core Functions): Teaching, Assessment, Content Creation.
- Domain 4-5 (Guiding Principles): Ethics and Human-centricity.
- Domain 6 (Enabling Mindset): Confidence and Adaptability.

This flow mirrors a teacher's journey from using AI for tasks, to governing its use responsibly, and finally to embracing it as a flexible tool.

4.6 Other Specific Changes

Merging "Decision-Making with AI" into other domains, this was a wise choice. The act of judging AI-recommended resources is a critical thinking skill that naturally belongs within "Interdisciplinary Teaching" and "Multimedia Creation," making those domains more robust. Besides, combining "Designing AI" with "Data, Ethics", the modified scale wisely scales back the expectation for teachers to be AI developers. Instead, it reframes this as the ability to "participate in developing or assessing" tools. This is a much more realistic and valuable competency for most educators, positioning them as informed contributors and evaluators rather than required builders. Additionally, elevating "Confidence" to a Core Domain: Retaining "Confidence and Adaptability" as a final domain is psychologically astute. Technical proficiency is futile without the willingness to use it. This domain explicitly addresses potential technophobia and resistance, which is crucial for successful adoption.

5. CONCLUSION

The study develops the TAICS scale for assessing teacher AI competence in the context of border region. The scale considers teachers’ comprehension of AI, engagement in learning AI, and ability to use AI for educational purposes. This scale serves as the foundation for comprehending the primary teaching skills inside AI-driven learning settings. The scale consists of six dimensions: Interdisciplinary Teaching with AI, Assessment with AI, Multimedia Creation with AI, Human-Centric and Ethical AI Use, Data Security and AI Evaluation and Confidence and Adaptability with AI. The modified TAICS integrated border region context demonstrates a clear understanding that effective technology integration is not about mastering a universal set of tools, but about adapting those tools to specific cultural, geographical, and infrastructural contexts. In subsequent research, the reliability and validity of this scale can be further examined, its content can be continuously refined, and in-depth discussions can be conducted on items that are subject to controversy (the term "localized" is powerful but could benefit from further exemplification in a training context, e.g., does it mean in the local language/dialect, or just with local themes?).Ultimately, this refinement aims to improve the scale’s effectiveness in assessing AI competence and self-efficiency among faculty in frontier universities.

REFERENCES

[1] Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman.
[2] Demeshkant, N., Trusz, S., & Potyrała, K. (2022). Interrelationship between levels of digital competences and Technological, Pedagogical and Content Knowledge (TPACK): A preliminary study with Polish academic teachers. *Technology Pedagogy and Education*, 31(5), 579–595. https://doi.org/10.1080/1475939X.2022.2092547
[3] Falloon, G. (2020). From digital literacy to digital competence: The teacher digital competency (TDC) framework. *Educational Technology Research and Development*, 68(5), 2449–2472. https://doi.org/10.1007/s11423-020-09767-4
[4] Forester, M., Kahn, J. H., & Hesson-McInnis, M. S. (2004). Factor structures of three measures of research self-efficacy. *Journal of Career Assessment*, 12(1), 3-16.
[5] Kozcu Çakır, N. (2020). The relation between self-efficacy beliefs towards science teaching and learning strategies of primary school teacher candidates. *International Journal of Research in Education and Science (IJRES)*, 6(2), 347-360. https://doi.org/10.46328/ijres.v6i2.975
[6] Miao, F. (2024). Generative AI and its uses in education: Foundational controversies and responding strategies. *Open Education Research*, 30(1), 4-15. https://doi.org/10.13966/j.cnki.kfjyyj.2024.01.001
[7] Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK) the development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education*, 42(2), 123–149. https://doi.org/10.1080/15391523.2009.10782544
[8] Thomas K. F. Chiu Zubair Ahmad & Murat Çoban. (2024). Development and validation of teacher artificial intelligence (AI) competence self-efficacy (TAICS) scale. *Education and Information Technologies* (2025) 30: 6667–6685 https://doi.org/10.1007/s10639-024-13094-z
[9] UNESCO. AI competency framework for teachers. United Nations Educational, *Scientific and Cultural Organization*; 2024. Available from: https://unesdoc.unesco.org/ark:/48223/pf0000391104.
[10] Vosough Matin, M. (2023). Investigation of self-efficacy perceptions and professional attitudes of teachers working in special education schools. *International Journal of Research in Education and Science (IJRES)*, 9(1), 228- 240. https://doi.org/10.46328/ijres.3123
[11] Yang, Y. (2023). Opportunities, challenges, and countermeasures for professional development of primary and secondary school teachers under the “double reduction” policy. *Educational Administration and Research*, 13, 7-10.
[12] Zhu, Z., & He, B. (2012). Smart education: A new frontier of educational informatization. *Journal of Educational Technology Research*, 12(12), 5-13.