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ORIGINAL CONTRIBUTION

Generative AI and TCM Teaching Materials

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Abstract— The growing role of Generative Artificial Intelligence (GenAI) in transforming education poses both opportunities and challenges for achieving Sustainable Development Goal 4 (Quality Education) through curriculum innovation, particularly in specialized fields like Traditional Chinese Medicine (TCM). This research examines the effect of GenAI utilization on teachers' assessments of teaching content quality among TCM educators in Shandong, China, with an investigation into its interactive role with teachers' perceptions. A total of 213 TCM educators from schools and academic institutions responded to a standardized survey, and data were analyzed through descriptive statistics, ANOVA, and Partial Least Squares Structural Equation Model (PLS-SEM). The findings indicate a statistically significant positive correlation existed between GenAI utilization efficacy and educators' assessments of material quality (β= 0.371, p < 0.001), with educators' ratings improving significantly on such factors as material clarity, originality, as well as teaching order and organization. Mediation analysis also attested to teachers' perception playing an important mediation role in this correlation (β= 0.470, p < 0.001), citing that educators' confidence and positive perspectives on GenAI utilization enhance its pedagogical value. The model explained 22.1% of the variance in material quality ratings by educators, and utilization and perception were shown to be major predictors. The ANOVA findings also corroborated that GenAI utilization was significantly correlated with differences in different levels of rating material quality (F (1,211) = 7.017, p = 0.009). These findings reinforce how embracing GenAI tools and cultivating a positive teacher attitude is key to realizing its pedagogical value in its entirety. The research provides actionable insights for policymakers, curriculum developers, and school leaders in implementing AI in culturally established areas, noting that meaningful teacher engagement and support are crucial to leveraging technology for Sustainable Development Goal 4 (Quality Education).

Index Terms— Generative Artificial Intelligence (GenAI), Traditional Chinese Medicine (TCM), Teaching material development, Higher education, Sustainable Development Goals (SDG), Educational technology, AI in education, TCM educators, Instructional content quality, China, Technology integration in pedagogy

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Introduction

"Integrating Generative AI (GenAI) into Traditional Chinese Medicine (TCM) education marks a significant step toward updating instructional methods without losing sight of deeply rooted cultural knowledge (Xiaoxuan & Yong, 2023). Given the complexity of TCM, tools that can quickly process and organize large volumes of information—such as AI—may offer practical support in how knowledge is taught and

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applied (W. Li et al., 2024). As global healthcare systems continue to evolve, combining AI-driven insights with traditional treatment practices could help TCM practitioners remain relevant and responsive to contemporary needs (Feng et al., 2021; Lu et al., 2021). However, it's important to note that successful implementation depends on more than just the availability of AI tools. Educators' attitudes—how they view GenAI's role and usefulness in the classroom—play a central role in how effectively it is integrated into teaching (Ruiz-Rojas et al., 2023; Sukumaran & Khair, 2024). This study, therefore, explores not only the extent to which GenAI influences the development of educational content but also how teachers' perceptions shape the overall quality of these materials."

"This study also looks into how educators' personal experiences with GenAI—particularly their confidence and satisfaction in using it—might influence the outcomes. It focuses on whether educators perceive improvements in aspects such as content clarity, creativity, and student engagement when GenAI is involved. From this, two main assumptions are proposed. First (H1), the effective use of GenAI contributes positively to how educators rate the overall quality of the materials they produce. Second (H2), educators' perceptions act as a key link in this process, mediating the connection between GenAI usage and the perceived value of the content. Grounded in the rich cultural setting and distinct pedagogical environment of TCM education in Shandong, China, this study offers timely reflections on how emerging technologies like GenAI can be thoughtfully adapted to support tradition-based teaching in modern learning contexts.

Problem statement

"Generative Artificial Intelligence (GenAI) has opened up new possibilities for developing educational content across many academic fields (Jam et al., 2011; Prather et al., 2025). While much of the existing research has focused on general education—particularly in areas like language instruction and curriculum planning—there is noticeably less work examining how GenAI is used in more culturally rooted and discipline-specific areas (Zhu et al., 2024). Traditional Chinese Medicine (TCM) is one such field, grounded in centuries of philosophical and cultural practice (Xiaoxuan & Yong, 2023). Bringing GenAI into TCM education, therefore, requires careful consideration to ensure that innovation doesn't come at the cost of authenticity (Huang et al., 2024)."

"Although GenAI may help improve how teaching materials are structured, presented, or designed creatively, educators working within traditional knowledge systems often find themselves navigating a delicate balance. On the one hand, they are encouraged to embrace new tools; on the other, they must protect the depth and integrity of long-established knowledge (Dickey & Bejarano, 2024). Currently, there's little empirical research that captures how TCM educators actually feel about using GenAI or whether these tools truly add value—or risk oversimplifying culturally rich content (Janumpally et al., 2025). This lack of evidence presents a challenge, especially for policymakers and institutions looking to design AI integration strategies that are respectful of traditional educational settings."

"Shandong Province is a particularly suitable location to explore these questions. Known for its leadership in TCM education and research, the region houses some of China's most established TCM universities, where classical traditions are actively combined with modern clinical practice. With its robust academic infrastructure and recent efforts to reform teaching methods, Shandong offers a valuable setting to investigate how GenAI might be meaningfully used in a field where innovation and cultural preservation are both important (X. Li, 2017; Tago et al., 2022). Gaining insight into this balance is crucial for ensuring that AI adoption enhances—not erodes—the core principles that define traditional medical education."

Literature Review

TCM education and pedagogical challenges

"Traditional Chinese Medicine (TCM) education has developed gradually over many centuries, shaped by a combination of philosophical ideas, practical experience, and the careful handing down of knowledge. At its core are classical texts like the Huangdi Neijing (Yellow Emperor's Inner Canon), which emphasize holistic thinking, personalized care, and the constant balance between yin and yang (Jam et al., 2013; Matos et al., 2021). In the past, learning TCM was less about formal schooling and more about close relationships—students would often learn directly from experienced masters through oral instruction and practical guidance (Masters, 2019). These relationships weren't just about acquiring clinical skills; they also emphasized personal ethics and scholarly discipline (Hong, 2018; Roushangar et al., 2024). Confucian values were often part of the learning process, highlighting the moral and philosophical foundations of traditional Chinese teaching."

"As China began modernizing its healthcare system in the 20th century, TCM gradually found its way into formal academic settings through more standardized curricula (Ghaffar et al., 2024; X. Li, 2017). These changes allowed traditional medicine to be integrated into the wider medical education system. Today, TCM educators face a challenging task—they must keep traditional knowledge alive while also meeting national education guidelines and aligning with international standards for medical training (Xue et al., 2015). Alongside these expectations, there's still a strong push to retain the core philosophies that set TCM apart from Western biomedicine."

"This includes its unique way of diagnosing illnesses, the conceptual theories behind treatments, and its deep cultural roots (Haider et al., 2019; Matos et al., 2021). Balancing tradition with innovation isn't always easy, and for TCM educators, this tension is often felt in their daily work. Many modern programs now use clinical simulations, case-based learning, and digital tools to help students engage with the material in more practical ways. However, these newer approaches must still respect the heart of TCM—its focus on holistic care and individualized healing (Han et al., 2019; Hashim et al., 2017)." In this sense, educators are not just lecturers; they play the role of guardians of a living tradition. They guide students through ancient texts, help them connect theory to clinical practice, and encourage them to consider the broader social and cultural aspects of traditional healing (Chen et al., 2015; Zhang et al., 2015). As digital tools—especially artificial intelligence—become more common in universities, TCM educators face the task of deciding how best to use them. The real challenge is making sure these technologies support, rather than weaken, the core values of traditional teaching. Doing so requires not only flexibility in how they teach but also a strong understanding of the philosophical foundations that define TCM (Zhou et al., 2024).

Re framing TAM and UTAUT to understand GenAI adoption in TCM instruction

"The Technology Acceptance Model (TAM), developed by Davis in 1989, is still one of the most commonly used models for understanding how people adopt new technologies (Brynjolfsson et al., 2025; Rap & Blonder, 2024). It's built around two main ideas. The first is Perceived Usefulness (PU)—whether someone thinks a technology will actually help them do their job better. The second is Perceived Ease of Use (PEOU)—how simple or straightforward the technology seems to use. Together, these factors play a big role in whether people decide to use a tool or not. This is especially relevant in education, where digital platforms—like Learning Management Systems (LMS), online learning environments, and now Generative AI (GenAI)—are becoming part of everyday teaching and learning (Mello et al., 2023)."

"In this study, the Technology Acceptance Model (TAM) is used to better understand how educators in Traditional Chinese Medicine (TCM) perceive the use of GenAI in their teaching practices (Ghimire & Edwards, 2024). Since TCM is rooted in centuries-old traditions and teaching methods, the idea of bringing in AI tools can feel like a major shift. TAM helps explore whether educators find GenAI useful in what they do and whether they think it's easy enough to use (Cordero et al., 2024; Sungkhapong et al., 2016). Beyond that, it sheds light on what might make teachers more or less likely to adopt such tools in their classrooms (Munawar & Misirlis, 2024). By examining these issues, the study hopes to offer practical guidance for anyone trying to bring AI into educational spaces where tradition still plays a central role."

Methodology and Data Analysis

"This study used a quantitative cross-sectional survey to explore how Generative Artificial Intelligence (GenAI) influences the development and perceived quality of teaching materials among Traditional Chinese Medicine (TCM) educators in Shandong Province, China." The research focused on instructors teaching TCM-related subjects in both vocational and academic institutions. Data collection took place over a four-week period between October and November 2024. A structured questionnaire was distributed to a stratified random sample of 213 educators, who completed it independently."

"Stratification was done based on four key factors: type of institution (vocational vs. academic), years of teaching experience, gender, and whether participants had previously engaged in AI-related professional training. This approach helped ensure that the sample was balanced and reflected a range of perspectives across the region's TCM education sector. The sample size was sufficient to support advanced statistical analyses, including Partial Least Squares Structural Equation Modeling (PLS-SEM), which requires both statistical power and appropriate construct measurement for model testing and validation."

"The survey used in this study was designed based on two well-established models: the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). These frameworks helped guide the study in understanding how educators accept and use GenAI tools. To make sure the questions were relevant and reflected current trends, several constructs were adapted from recent studies on AI adoption in educational settings."

"The final questionnaire was divided into five sections. The first gathered basic demographic and professional information from participants. The second asked about how often and how consistently they used GenAI tools. The third focused on educators' views about GenAI's role in helping them develop teaching materials. The fourth looked at how GenAI might influence specific aspects of content—such as clarity, organization, creativity, and how engaging it was. Lastly, the fifth section asked about their overall satisfaction and confidence when using GenAI for instructional design."

"Most of the items were rated on a five-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree." To make sure the questionnaire was valid and made sense in the context of TCM education, it was reviewed by three experts—two in educational technology and one senior TCM educator. A pilot test was also carried out with 50 educators. Based on their feedback, a few questions were revised for better clarity and contextual fit. Reliability checks showed high internal consistency across the sections, with Cronbach's alpha values all above 0.87."

"The survey was conducted online. Participation was entirely voluntary, and responses were anonymous. Before starting, each participant received a consent form explaining the study's purpose, how their data would be kept confidential, and their right to withdraw at any time. Ethical clearance was granted by the research ethics committee at the lead investigator's institution.

For analysis, SPSS Version 26.0 and SmartPLS 4.0 were used. Descriptive statistics helped summarize the demographic details and general usage patterns of GenAI tools. Pearson correlation was run to explore initial links between how often GenAI was used and how educators rated their teaching materials. Multiple linear regression was then used to see if factors like GenAI usage, previous training, and perceived usefulness could predict how teachers evaluated the overall quality of their instructional content. An Exploratory Factor Analysis (EFA) was carried out to explore how the constructs were grouped using principal component analysis with varimax rotation. After that, Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to examine both the measurement and structural models. For the measurement model, the analysis looked at indicator reliability, convergent validity, and internal consistency. In the structural model, the goal was to test the hypothesized links between how effectively GenAI was used, teachers' perceptions of its integration, and how they rated the quality of teaching materials.

Bootstrapping with 5,000 subsamples was used to check whether the path coefficients were statistically significant. A mediation analysis was also conducted to find out if teacher perceptions played a role in explaining the relationship between GenAI usage and perceived material quality."

This combination of methods helped provide a clearer picture of both the direct and indirect effects of GenAI in the context of TCM education, which is known for its cultural depth and traditional focus. The results from this study can support institutional planning, guide professional training for educators, and open up new directions for research on the role of AI in specialized teaching contexts.

Results

Table I
Demographic profile and AI usage characteristics of TCM subject teachers in Shandong, China

Variable	Category	N	%
Age Group	1	16	7.5%
	2	48	22.5%
	3	119	55.9%
	4	30	14.1%
Gender	1 (Male)	76	35.7%
	2 (Female)	137	64.3%
Years Teaching in TCM	1 (0–5 years)	50	23.5%
	2 (6–10 years)	44	20.7%
	3 (11–20 years)	100	46.9%
	4 (More than 20 years)	19	8.9%
Received Training	1 (Yes)	191	89.7%
	2 (No)	17	8.0%
	3 (Not Sure)	5	2.3%
Frequent Use of AI	1 (Yes)	174	81.7%
	2 (No)	39	18.3%

According to survey data gathered from Traditional Chinese Medicine (TCM) subject teachers in Shandong, China, respondents' demographic profile and background information reveal several notable insights. Most respondents (55.9%) belong to the 40–49 age group, reflecting a mid-career majority. This is followed by 22.5% belonging to the 30–39 range, younger respondents (20–29), and respondents aged 50 or more, making an overall 7.5% and 14.1%, respectively. Regarding gender distribution, there are more female respondents (64.3%) than males (35.7%) in this sample, reflecting greater representation by females in TCM teaching roles. Regarding teaching experiences, almost half (46.9%) of respondents have been teaching TCM for 11–20 years, reflecting an established teaching proficiency level in the subject area."

"In contrast, 23.5% have 0–5 years of teaching experience, while 20.7% have 6–10 years of teaching. However, a minuscule segment (8.9%) has over 20 years of teaching experience. In terms of training offered for Generative Artificial Intelligence (GenAI), overwhelmingly (89.7%) reported having been given formal training, with only 8.0% stating no training and 2.3% unsure of this. Moreover, data indicate that a high percentage (81.7%) use AI tools in teaching at frequent intervals, as opposed to 18.3% of respondents who reported not using such tools. The findings indicate a teaching force that contains extensive teaching experiences and applies GenAI technologies with some degree of frequency in teaching. The prevalence rates for high levels of training received, and frequent use of AI tools indicate aggressive adoption rates for GenAI among TCM teachers, making them prime beneficiaries or users of advancements in educational technologies."

Table II
ANOVA summary showing a significant effect of GenAI usage frequency on perceived teaching content quality

Influence of GenAI on Content Creation and Quality					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.816	1	.816	7.017	.009
Within Groups	24.535	211	.116		
Total	25.351	212			

"One-way ANOVA was used to investigate how the frequency with which Generative AI tools are used relates to perceived teaching materials quality. The dependent variable—perceived quality—was operationalized as an aggregate response based on a five-item Likert-scale measure for measuring improvements made in clarity, accuracy, organization, speed, and overall quality of content. The tests demonstrated a statistically significant effect on perceived content quality by frequency of GenAi use, $F(1, 211) = 7.017$, $p = .009$, and thus, differences in frequency of use relate to substantive variations in how teachers perceive teaching materials quality. This is, as hypothesized, suggesting that increased use may improve teachers' ratings regarding the content quality because they become familiar with such tools and implement them more efficiently in teaching."

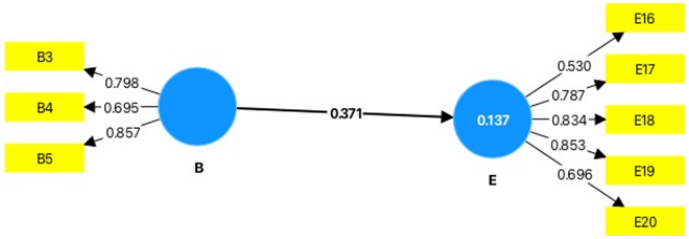


Fig. 1 *Structural equation model illustrating the influence of generative AI usage effectiveness on the perceived quality of instructional materials*

To evaluate the impact of Generative Artificial Intelligence (GenAI) on the perceived quality of teaching materials, a Structural Equation Modeling (SEM) analysis was conducted using SmartPLS. The model examined the direct relationship between GenAI Usage Effectiveness and Perceived Material Quality, which is in line with Hypothesis 2. The measurement model demonstrated acceptable reliability and validity. The construct GenAI Usage Effectiveness was measured using three indicators (B3, B4, B5), with standardized loadings of 0.798, 0.695, and 0.897, respectively, all exceeding the recommended threshold of 0.6. The construct Perceived Material Quality was measured by five indicators (E16 to E20), with four items demonstrating satisfactory loadings ranging from 0.696 to 0.851. One item (E16) showed a lower loading (0.530) but was retained due to its conceptual relevance. The structural model revealed a moderate positive relationship between GenAI usage and perceived material quality. The path coefficient was $\beta = 0.371$, and the coefficient of determination (R^2) was 0.137, indicating that GenAI usage explained approximately 13.7% of the variance in the perceived quality of course materials.

Table III
Bootstrapping results for the direct effect of GenAI usage effectiveness on perceived material quality

	Original sample (*O*)	Sample mean (*M*)	Standard deviation (STDEV)	*T* statistics (|O/STDEV|)	*p* values
B -> E	0.371	0.393	0.056	6.665	0.000

Bootstrapping with 5,000 subsamples confirmed the statistical significance of this relationship ($t = 6.665$, $p < 0.001$). These results provide strong support for Hypothesis 2, suggesting that the effective use of GenAI tools significantly enhances the perceived quality of course materials developed by Traditional Chinese Medicine (TCM) educators. The findings reinforce the potential of GenAI as a pedagogical aid in improving the clarity, structure, and engagement of instructional content.

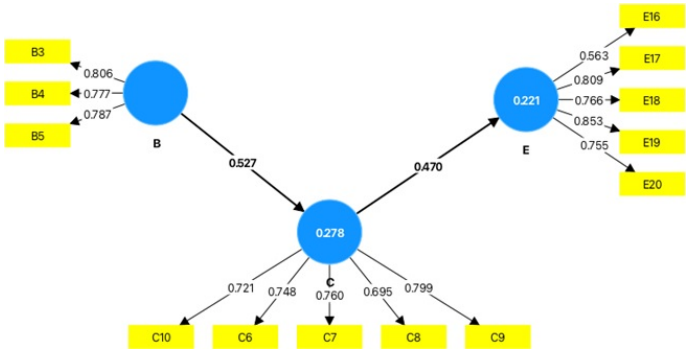


Fig. 2 *The mediation model examines the indirect effect of GenAI usage effectiveness on perceived material quality through teacher perception*

The mediation model was constructed to explore the influence of Generative AI (GenAI) usage on the perceived quality of teaching materials, with teacher perception of GenAI integration acting as a mediating variable. The structural model, as illustrated in Figure 2, included three latent constructs: GenAI Usage Effectiveness (B3, B4, B5), Teacher Perception (C6 to C10), and Perceived Material Quality (E16 to E20). The path coefficients indicated a positive relationship between GenAI Usage to Teacher Perception (β = 0.527) and from Teacher Perception to Perceived Material Quality (β = 0.470). The model's explanatory power was moderate, with R^2 values of 0.278 for Teacher Perception and 0.221 for Perceived Material Quality, suggesting that GenAI usage and perception together account for 22.1% of the variance in perceived content quality.

Table IV
Bootstrapping results for the structural model paths: GenAI usage effectiveness → teacher perception and teacher perception → perceived material quality

	Original sample (*O*)	Sample mean (*M*)	Standard deviation (STDEV)	*T* statistics (|O/STDEV|)	*p* values
B -> C	0.527	0.536	0.057	9.205	0.000
C -> E	0.470	0.483	0.061	7.683	0.000

Bootstrapping with 5,000 subsamples was performed to assess the significance of the model paths. As shown in Table I, the path from GenAI Usage to Teacher Perception was significant (β = 0.527, t= 9.205, p < 0.001), and the path from Teacher Perception to Perceived Material Quality was also significant (β = 0.470, t = 7.683, p < 0.001).

These results indicate that both the direct and indirect relationships within the model are statistically significant. The direct effect of GenAI Usage on Perceived Material Quality (β = 0.274) remained positive and meaningful, supporting a partial mediation model in which the mediating construct enhances—but does not fully account for—the relationship between the independent and dependent variables.

Together, these findings support both Hypotheses 1 and 2. GenAI Usage has a direct positive impact on the quality of teaching content materials, while teachers' perceptions of GenAI serve as a significant mechanism that mediates this relationship. This suggests that in order to maximize the effectiveness of GenAI in educational settings, it is important to implement the tools and cultivate teachers' confidence, satisfaction, and belief in the relevance of AI within the curriculum. Enhancing teacher buy-in may, therefore, play a critical role in translating technological adoption into meaningful instructional improvements.

Discussion

This study aimed to investigate the influence of Generative Artificial Intelligence on the development of teaching materials among Traditional Chinese Medicine subject teachers in Shandong, China. Specifically, it examined how the effective use of GenAI tools impacts the perceived quality of course materials and whether teachers' perceptions mediate this relationship. Drawing on Technology Acceptance Theory and cognitive learning frameworks, this study contributes to the growing literature on AI integration in education by providing empirical insights into the dynamics between technological adoption, user perception, and instructional quality.

The Structural Equation Modeling and bootstrapping analysis yielded several key findings. Firstly, there was a significant and positive direct relationship between the Effectiveness of GenAI Usage and Perceived Material Quality (β = 0.371, t = 6.665, p < 0.001). This supports the hypothesis that TCM educators who leverage GenAI tools more effectively perceive the teaching materials they produce to be of higher quality. The strong reliability of the indicators measuring GenAI usage, such as ease of structuring materials, speed of content creation, and clarity improvement, corroborates the consistency of this construct. Likewise, the indicators for perceived quality reflect a high degree of satisfaction with the AI-generated content, its consistency, and its alignment with student learning needs.

The results from the mediation model further enrich this interpretation. The model confirmed a statistically significant indirect effect from GenAI Usage Effectiveness to Perceived Material Quality via Teacher Perception of GenAI ($\beta = 0.470$, $t = 7.683$, $p < 0.001$), while the direct effect remained significant ($\beta = 0.274$).

These results support Hypothesis 2 and indicate partial mediation—that is, the positive impact of GenAI usage on material quality is not solely due to the tools themselves but is also significantly influenced by how teachers perceive and internalize the role of AI in their professional practice. Teachers who expressed higher confidence in using GenAI, satisfaction with its outcomes, and belief in its relevance to TCM education were more likely to associate GenAI with improved teaching material quality.

Implications for theory

These findings contribute to the extension of the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) in the context of AI-enhanced teaching. According to TAM, perceived usefulness and ease of use are key predictors of technology adoption. The present study shows that not only is GenAI perceived as functionally effective (e.g., faster and clearer content development), but that perception of integration and alignment with teaching values is a critical bridge between usage and actual outcomes (Ghimire & Edwards, 2024). This aligns with UTAUT's emphasis on performance expectancy and facilitating conditions, as the results highlight the importance of both external support and internal acceptance in translating GenAI usage into quality outcomes (Rana et al., 2024).

Furthermore, the investigation deepens our understanding of how AI integration influences cognitive engagement and knowledge construction within educational environments, and it suggests that effective AI integration not only depends on the technology itself but also on how educators perceive and utilize these tools to facilitate deeper, more meaningful learning experiences.

The findings also align with cognitive and constructivist theories such as Vygotsky's Sociocultural Theory and Sweller's Cognitive Load Theory, which posit that external tools, when well-integrated, can scaffold complex cognitive tasks and enhance learning outputs Venkat et al. (2020).

In this study, GenAI tools can be conceptualized as cognitive aids that alleviate routine tasks, enabling teachers to devote more attention to higher-level instructional planning and conceptual development. However, the realization of this benefit is contingent on the teacher's perception and internalization of the technology—echoing Vygotsky's emphasis on the role of mediation and meaningful interaction between the user and the tool.

Practical implications

From a practical standpoint, the findings hold significant implications for educational institutions, particularly in the integration of AI technologies into teaching and curriculum design. First, while the technological capabilities of GenAI tools are important, professional development and teacher support play an equally crucial role in driving successful adoption. Institutions should invest in training programs that not only familiarize educators with the technical aspects of GenAI but also emphasize its pedagogical potential. This will help foster more positive perceptions and encourage deeper integration into teaching practices.

The partial mediation identified in this study suggests that technology alone cannot guarantee educational improvement. The human factor—especially teacher beliefs and attitudes—remains central. Administrators and policymakers must recognize the importance of user experience and trust in shaping the success of any AI initiative. For TCM education, in particular, where tradition, cultural nuance, and precision are highly valued, building confidence in AI tools requires addressing concerns about content authenticity, contextual relevance, and ethical use.

Furthermore, the study provides a useful framework for measuring AI impact in specialized educational domains. While much of the existing literature focuses on AI in general classroom or language education settings, this study applies it to a culturally rich and technically demanding field such as Traditional Chinese Medicine. This opens the door for future researchers to apply similar models in other specialized disciplines—such as legal education, engineering, or the arts—where AI integration must balance standardization with disciplinary depth.

Conclusion

"Although this study provides rich insights into how Generative AI improves teaching material quality as perceived by TCM educators, it is not without limitations. The sample was only drawn from teachers in Shandong Province; thus, its findings may have reduced generalizability across other areas or departments. The use of self-reported data also poses risks of bias due to variations in familiarity with or desirability of AI.

Future studies would do well to use objective measures of material quality, longitudinal analysis of GenAI's learning effects, and other mediating or moderating variables such as teaching experience, digital literacy, or institutional support. Comparative qualitative and other approaches—such as interviews or multi-group analyses—may also provide deeper insights into how GenAI is implemented across different learning environments. In spite of these limitations, this study establishes that GenAI improves teaching material significantly, where teacher perception plays a partial mediation role. These results highlight an integrated assessment that incorporates technical adoption with trust building, training, and pedagogic alignment to maximize the transformational capabilities of GenAI in TCM teaching."

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