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Measuring AI readiness in education: validation of the German AI readiness scale for educators

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Abstract

Purpose – This study aimed to validate the German version of the AI readiness scale for educators and explore its correlation with key teacher characteristics, including digital competencies, age, gender and teaching experience.

Design/methodology/approach – A total of $N = 153$ teachers from German-speaking Switzerland participated in the study. Confirmatory factor analysis (CFA) was conducted to validate the four-factor structure of the AI readiness scale, which includes Cognition, Ability, Vision, and Ethics.

Findings – The CFA results confirmed the validity and reliability of the scale (CFI = 0.92, TLI = 0.903, RMSEA = 0.088), with strong internal consistency (Cronbach's alpha > 0.79). Correlational analyses revealed significant relationships between AI readiness and digital competencies, with teachers exhibiting higher digital skills showing greater AI readiness. While initial analyses indicated gender- and age-related differences in AI readiness, these effects became non-significant once digital competencies were statistically controlled, emphasizing the central role of digital competencies for AI readiness in educators.

Practical implications – The findings offer implications for professional development programs, highlighting the need for targeted interventions that both foster digital skills and consider demographic differences among educators.

Originality/value – This study contributes to the measurement of AI Readiness of educators in the German context and underscores the importance of digital competencies for teachers' preparedness to engage with AI.

Keywords Artificial intelligence, Scale validation, AI readiness, Teachers, Educators

Paper type Research article

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1. Introduction

In recent years, artificial intelligence (AI) has become an integral part of various sectors, including education. In educational contexts, AI technologies offer the opportunity to support personalized, flexible, and inclusive learning experiences. They can assist teachers by providing feedback, analyzing student data, and enhancing instructional design through tools such as virtual simulators and intelligent tutoring systems and thus may improve the quality and effectiveness of teaching (Luckin and Holmes, 2016; Hwang *et al.*, 2020; Gaur *et al.*, 2024; Singh and Thakur, 2024). However, successfully and effectively integrating AI into teaching and learning environments requires that educators are adequately prepared to use these technologies (Qin *et al.*, 2020). Research consistently points to limited AI readiness among teachers as a major barrier to effective implementation in schools (Zhang *et al.*, 2023). While AI presents exciting opportunities, it also poses significant challenges (Hamilton *et al.*, 2023). To harness its potential effectively, educators need not only technical proficiency in operating AI tools but also robust pedagogical knowledge for their meaningful integration into teaching and learning processes. This includes a comprehensive understanding of how AI functions, its educational potential, and the ability to critically evaluate its applications (Giannakos *et al.*, 2024). Teachers must be capable of selecting appropriate AI tools aligned with specific instructional objectives and applying them in ways that genuinely enhance student learning (Ng *et al.*, 2023). In addition, educators should be prepared to address the ethical dimensions of AI use – particularly with regard to data privacy, bias, and transparency (Giannakos *et al.*, 2024). Or in the words of Wang *et al.* (2023) educators "are expected to develop an adequate understanding of AI and become educated users as well as educators" highlighting the dual responsibility to both competently apply and teach AI technologies. Assessing and strengthening teachers' AI readiness is therefore essential for ensuring that AI technologies are not only adopted but used effectively and responsibly in educational contexts. A lack of readiness risks not only limiting the pedagogical benefits of AI but also exacerbating existing digital inequalities. If educators are not adequately equipped, they may struggle to prepare students for life and work in an AI-driven world, thereby narrowing access to future technological and civic participation (Casal-Otero *et al.*, 2023).

1.1 AI readiness in education

While AI readiness is often discussed in relation to organizations' capacity to adopt and implement AI technologies (e.g. Jöhnk *et al.*, 2021; Holmström, 2022), it also applies at the individual level. The concept of AI readiness is especially important in the context of education, where educators need to transition from a basic understanding of AI to a more nuanced comprehension of how AI can support teaching and learning (Ayanwale *et al.*, 2024). This is also reflected in the definition by Luckin *et al.* (2022) who refer to AI readiness as "a way to describe the transition that those working in education and their students need to make from not understanding what AI is and what AI can do, to being able to understand, in non-technical terms, what AI is capable of achieving". This shift is particularly significant because AI in education not only involves using digital tools but also reimagining how educational processes can be enhanced through intelligent technologies (Walia and Kumar, 2022).

AI readiness is a multifaceted construct that encompasses various dimensions. According to Karaca *et al.* (2021), AI readiness can be broken down into four core components: cognitive readiness, the ability to use AI effectively, the vision for AI's role in education, and ethical considerations related to its application. Each of these components plays a critical role in determining how well educators can integrate AI into their teaching practices and curricula. Cognitive readiness involves understanding the theoretical concepts behind AI, while the ability to use AI refers to practical skills in applying AI tools. The vision for AI concerns how educators perceive AI's potential to reshape educational outcomes, and ethics addresses the concerns surrounding privacy, fairness, and transparency in AI applications.

1.2 Relationship between AI literacy and AI readiness

AI literacy is widely defined as a set of competencies – including technical knowledge, ethical awareness, critical evaluation, and practical application – enabling individuals to understand, interact with, and responsibly use AI technologies (Long and Magerko, 2020; Ng *et al.*, 2021; Allen and Kendeou, 2024; Almatrafi *et al.*, 2024). Current studies show that AI literacy is a critical enabler of AI readiness, but the connection is nuanced: AI literacy alone does not guarantee readiness for the use of AI in education, as factors such as confidence, perceived relevance, self-efficacy, and contextual support also play significant roles (Zhao *et al.*, 2022; Wang *et al.*, 2023; Du *et al.*, 2024; Özüdoğru and Durak, 2025). Hence, AI literacy is a necessary but not sufficient condition for AI readiness; interventions should address mediating factors to fully realize the benefits of AI literacy in educational practice.

1.3 Measuring AI readiness

Despite its growing importance, there is a lack of validated tools for assessing AI readiness, particularly in educational settings. Existing scales, such as the one developed by Karaca *et al.* (2021) for medical students, have focused on specific domains. While there have been some efforts to extend AI readiness scales to the educational context in China (Wang *et al.*, 2023) and Turkey (Ramazanoglu and Akın, 2025), a comprehensive tool tailored to educators in German-speaking countries remains underexplored. This gap poses a significant challenge for both research and practice: without reliable and context-sensitive instruments, it becomes difficult to compare findings across studies, monitor progress over time, or design targeted professional development programs aimed at fostering AI readiness among educators. Moreover, the absence of such tools limits the ability of policymakers to make evidence-based decisions regarding curriculum development and teacher training standards. Addressing this gap is therefore essential for supporting educators in adapting to the evolving demands of AI-enhanced learning environments.

1.4 Objectives

This study aims to address this gap by validating the German version of an AI readiness scale for educators, specifically focusing on its reliability and construct validity. The scale is designed to measure the four key dimensions of AI readiness: cognition, ability, vision, and ethics. Initially developed by Karaca *et al.* (2021) for assessing AI readiness in medical students, the scale has been adapted for teachers and translated into Chinese by Wang *et al.* (2023). This study builds upon those efforts by assessing the psychometric properties of the scale in a German-speaking context, ensuring its applicability and reliability in this specific educational setting.

Additionally, this study explores the correlations between AI readiness and key variables such as digital competencies, age, gender, and professional experience. These relationships provide insights into possible factors associated with educators' adoption of AI and can inform the design of professional development programs tailored to enhance AI readiness (Yue *et al.*, 2024). Moreover, identifying such patterns may contribute to a better understanding of the conditions under which AI integration is most likely to succeed in educational settings.

1.5 Research questions

(1) What are the psychometric properties of the German version of the AI readiness scale for educators, and how well does it measure the different dimensions of AI readiness (cognition, ability, vision, and ethics)?

(2) To what extent do digital competencies correlate with educators' AI readiness?

(3) Are there significant differences in AI readiness based on demographic variables such as age, gender, and professional experience?

By addressing these questions, the study aims to contribute to a deeper understanding of the underlying aspects associated with AI readiness in education, providing valuable insights for both researchers and practitioners in the field of educational technology.

2. Methods

The data used to answer the research questions came from a supplementary survey conducted within a swissuniversities project, carried out in German-speaking Switzerland from 2021 to 2025. Out of 188 teachers who completed the main study, 153 (81.38%) answered the supplementary survey about AI. This study is based solely on data from these 153 participants.

2.1 Participants

The sample consisted of $N = 153$ teachers who were responsible for supervising and guiding student teachers in the context of their professional development. The participants were predominantly from primary and secondary schools, with a broad distribution of subjects taught. Participants' ages ranged from 24 to 63 years, with a mean age of $M = 41.23$ years ($Mdn = 40$ years). The sample was diverse in terms of gender, with 60.8% identifying as female and 38.6% as male and 0.7% did not indicate their gender. The sample also included a range of professional experience, with 8.5% of participants having fewer than 5 years of teaching experience, 44.4% having between 5 and 15 years, and 47.1% having more than 15 years of experience.

2.2 Procedure

A convenience sampling approach was employed, with invitations sent to educators from various educational institutions in the region. Data were collected through an online survey, which was distributed via email. The survey included several sections, such as the supplementary questionnaire featuring the newly developed AI Readiness Scale, measures of digital competencies, and demographic questions (including age, gender, and years of teaching experience). Completion of the survey of the current study took approximately 10 min, and participation was entirely voluntary.

2.3 Ethical considerations

The study adhered to established ethical standards for research involving human participants. The Ethics Committee of the institution (St.Gallen University of Teacher Education) confirmed that the project complies with the principles of ethically sound research practice and scientific integrity as outlined in the *Code of Scientific Integrity* of the Swiss Academies of Arts and Sciences. Informed consent was obtained from all participants, and all responses were anonymized to ensure confidentiality. Participants were also informed of their right to withdraw from the study at any time without any negative consequences.

2.4 Instruments

2.4.1 AI readiness scale for educators: development of the German version. The primary tool used in this study was the newly translated German version of the AI Readiness Scale for Educators. The scale was originally constructed for medical students by Karaca *et al.* (2021) and later adapted for teachers and translated into Chinese by Wang *et al.* (2023). This scale was developed through a multi-step process, ensuring both its linguistic and conceptual validity. First, the original scale by Wang *et al.* (2023) underwent a rigorous translation process from English to German, followed by back-translation to ensure the accuracy and consistency of the items across languages. Furthermore, a native speaker checked the translation for clarity and language quality. Experts in both AI and education reviewed the translated scale to ensure that the content was relevant, clear, and culturally appropriate for German-speaking educators.

During this adaptation, some items were slightly reworded to reflect the educational context and teaching practices in German-speaking regions, while preserving the original constructs and number of items. This process resulted in a refined version of the AI Readiness Scale that was both linguistically and contextually tailored to the educational context in German-speaking regions. The scale consists of 18 items and measures four key dimensions of AI readiness: cognitive readiness (i.e. Cognition), ability to utilize AI (i.e. Ability), vision for AI in education (i.e. Vision), and ethical considerations (i.e. Ethics). Participants rated their agreement with each item on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A description of each dimension and respective sample items in English are depicted in Table 1. The full translated German version of the scale can be retrieved from Table A1 in the Appendix.

2.4.2 Key teacher characteristics. Digital competencies: To assess participants' digital competencies, we used the subscales "Digital Skills" and "Perceived Usefulness of Digital Media" from the Fit4digit questionnaire (Zahn *et al.*, 2019). The "Digital Skills" subscale consisted of 6 items (e.g. "I have adequate resources to use digital media in my work"; $\alpha = 0.81$). The "Perceived Usefulness of Digital Media" subscale included 4 items (e.g. "Digital media are helpful for my work"; $\alpha = 0.88$). Participants rated their agreement with each item on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Although the Fit4digit questionnaire has not been explicitly validated for the teachers, it has been validated in German-speaking educational and work-related contexts. In the present sample, internal consistency was acceptable for both subscales, suggesting that the measures functioned reliably for teachers.

Demographic information: Participants were asked to provide their age in years, gender (male, female, other), and the number of years they had been teaching (i.e. teaching experience).

2.5 Data analysis

Data were analyzed using SPSS (Version 28) (IBM Corp, 2021) and Mplus (Version 8.4) (Muthén and Muthén, 2019) for statistical modeling. Descriptive statistics, such as means, standard deviations, and frequencies, were computed to summarize the demographic characteristics of the participants.

2.5.1 Confirmatory factor analysis (CFA). To assess the psychometric properties of the AI Readiness Scale for Educators, confirmatory factor analysis (CFA) was performed in Mplus, evaluating model fit indices such as the ratio of chi-square to the degrees of freedom (χ^2/df),

Table 1. AI readiness scale for educators: Dimensions and sample items

Dimension	Description	Number of items	Sample item
Cognition	The knowledge necessary to engage with AI technologies effectively	5	"I understand how AI technologies are trained and function in education"
Ability	The practical skills required to implement and utilize AI systems	6	"I can design different teaching approaches based on different functions of AI technologies"
Vision	The foresight as well as understanding of the strengths, limitations, opportunities and challenges of AI	3	"I foresee the opportunities and challenges that AI technologies entail for education"
Ethics	The moral considerations and responsibilities associated with the use of AI	4	"I use the data of teachers and students generated by AI systems following legal and ethical norms"

Note(s): Full translated scale see Appendix
Source(s): Authors' own work

the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the Tucker-Lewis Index (TLI), and the standard root mean square residual (SRMR). The criterion χ^2/df was adopted instead of χ^2 because χ^2 is excessively sensitive to the sample size (Hu and Bentler, 1999). Acceptable fit between the developed model and the collected data is indicated by a χ^2/df value of ≤ 5 (Iacobucci, 2010), a CFI and TLI of >0.90 (Russell, 2002), and an SRMR of <0.08 (Hu and Bentler, 1999). An RMSEA of between 0.08 to 0.10 provides a mediocre fit and below 0.08 shows a good fit (MacCallum *et al.*, 1996). Internal consistency was assessed using Cronbach's alpha for each dimension (i.e. each construct of the scale). To empirically evaluate the stability of the CFA model with $N = 153$, a Monte-Carlo simulation was conducted in Mplus using the population model parameters from the study.

2.5.2 Discriminant validity. To evaluate whether the four subscales of the AI Readiness Scale measure distinct constructs, the heterotrait-monotrait ratio of correlations (HTMT) was calculated.

2.5.3 Measurement invariance. Measurement invariance across gender (male vs female) and age (younger vs older, median split groups) was examined using multiple-group CFA in Mplus. We tested configural, metric, and scalar invariance following (Cheung and Rensvold, 2002) using changes in CFI ($\Delta CFI \leq 0.01$) as the primary criterion for invariance.

2.5.4 Correlations between AI readiness and key teacher variables. To examine the relationships between AI readiness and the key teacher characteristics (i.e. digital competencies, age, gender, and teaching experience), Pearson correlation coefficients were computed.

3. Results

3.1 Confirmatory factor analysis (CFA)

Confirmatory factor analysis (CFA) was conducted to validate the four-factor structure of AI readiness. The results are graphically depicted in Figure 1 and confirmed that the four constructs - Cognition, Ability, Vision, and Ethics - constitute a valid model for measuring AI readiness in educators ($\chi^2/df = 2.19$, $p < 0.001$, $CFI = 0.92$, $TLI = 0.903$, $RMSEA = 0.088$, 90% CI [0.074, 0.102], $SRMR = 0.054$). All fit indices fall within a range between acceptable to good fit. Factor loadings of the items ranged between 0.601 and 0.880 and were statistically significant for all items ($p < 0.001$).

The internal consistency of the four constructs was assessed using Cronbach's alpha. The Cognition subscale demonstrated excellent reliability ($\alpha = 0.865$), and the Ability subscale showed very high reliability ($\alpha = 0.921$), indicating strong internal consistency. The Vision ($\alpha = 0.789$) and Ethics ($\alpha = 0.797$) subscales demonstrated good reliability, which is acceptable given their smaller number of items. Corrected item-total correlations for all constructs ranged from moderate to strong, and "alpha if item deleted" values indicated that no items substantially reduced scale reliability. These values are presented in Table 2.

Although not all replications were successful, 23 Monte-Carlo simulations confirmed that factor loadings and covariances were reliably recovered. Across these simulations, factor loadings ranged from 0.788 to 1.079, latent covariances from 0.466 to 0.645, and residual variances from 0.216 to 1.053. Average fit indices indicated excellent model fit, with a mean $RMSEA$ of 0.020 ($SD = 0.014$) and a mean CFI of 0.993 ($SD = 0.008$), providing empirical support for the stability of the CFA results given the moderate sample size. Overall, these findings indicate that the scale items are coherent and consistently measure their respective constructs.

3.1.1 Discriminant validity. HTMT values between latent factors ranged from 0.732 to 0.921. All factor pairs except Cognition - Ability ($HTMT = 0.921$) fell below the commonly recommended threshold of 0.85, indicating generally good discriminant validity. The slightly higher value for Cognition -Ability suggests a moderate overlap between these two dimensions, which is theoretically plausible given their conceptual relatedness.

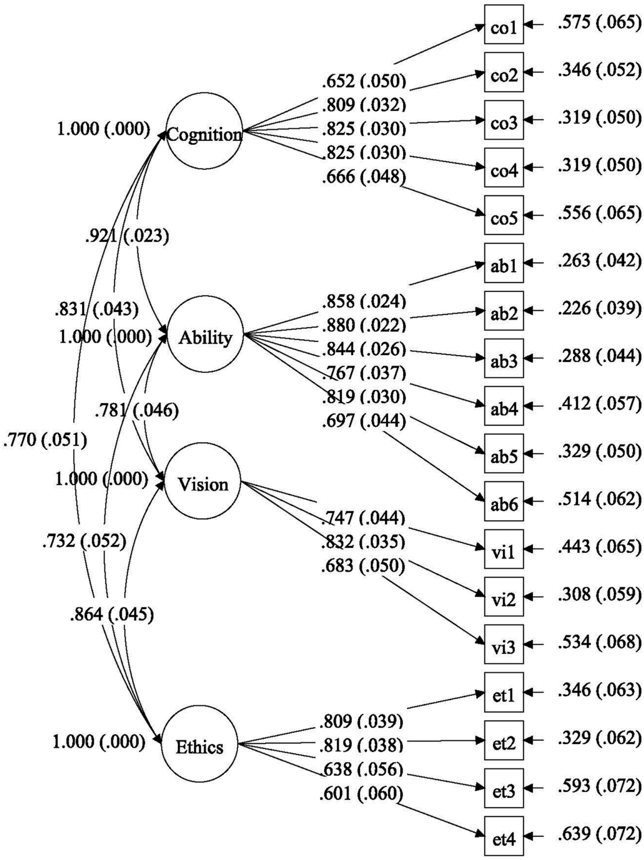

Figure 1. Confirmatory factor analysis of the AI readiness scale. Source: Authors' own work

Table 2. Internal consistency of AI readiness dimensions

Construct	Cronbach's alpha	Standardized Cronbach's alpha	Number of items	Corrected item-total correlation (range)	Alpha if item deleted (range)
Cognition	0.865	0.866	5	0.595–0.767	0.819–0.861
Ability	0.921	0.921	6	0.673–0.822	0.900–0.921
Vision	0.789	0.789	3	0.564–0.684	0.669–0.793
Ethics	0.797	0.801	4	0.540–0.683	0.711–0.788

Note(s): Values indicate the internal consistency for each dimension of AI readiness
Source(s): Authors' own work

3.1.2 Measurement invariance. Multiple-group CFA testing configural, metric, and scalar invariance for gender showed that across all three models, global fit indices remained identical ($CFI = 0.887$, $RMSEA = 0.101$), and χ^2 differences across models were negligible. This pattern indicates that the imposed equality constraints did not meaningfully affect model fit.

According to the recommended criterion of $\Delta CFI \leq 0.01$ (Cheung and Rensvold, 2002), these results support measurement invariance across gender. Similarly, for age groups, configural, metric, and scalar invariance models yielded identical *RMSEA* (0.093) and *CFI* (0.903), demonstrating measurement invariance between younger and older teachers. These results suggest that the AI Readiness Scale measures the same constructs consistently regardless of gender or age, supporting meaningful comparisons across these subgroups.

3.2 Correlations between AI readiness and key teacher variables

The study further explored the relationships between AI readiness and key teacher characteristics, including digital competencies, and demographic variables such as age, gender, and teaching experience. Descriptive statistics are depicted in Table 3 and correlations are displayed in Table 4. The findings revealed several significant correlations:

Digital competencies: Teachers with higher digital competencies (digital skills and perceived usefulness of digital media) demonstrated greater AI Readiness across all four dimensions, as well as on the overall scale ($r = 0.65$, $p < 0.001$). This suggests that teachers who are more digitally proficient and perceive digital media as useful are better prepared to adopt AI technologies in their teaching practices.

Gender: Male teachers were found to have higher AI readiness scores (total scale) compared to female teachers ($r = 0.16$, $p < 0.05$), suggesting that gender may influence teachers' perceptions and attitudes toward AI adoption in education. With regard to the factors, male teachers scored slightly higher on ability ($M\_male = 2.68$, $SD = 0.97$; $M\_female = 2.47$, $SD = 1.00$) and vision ($M\_male = 3.21$, $SD = 0.85$; $M\_female = 3.00$, $SD = 0.90$).

Teaching experience and age: Teachers with more teaching experience exhibited lower AI readiness (total scale; $r = -0.18$, $p < 0.05$). With regard to the factors, only vision showed no significant correlation with teaching experience. For age, we found that older teachers exhibited lower AI readiness regarding the factor cognition ($r = -0.17$, $p < 0.05$), indicating potential challenges in AI-related knowledge acquisition or conceptual understanding among more senior educators.

Controlling for digital competencies: When digital competencies were included as a control variable, the previously observed correlations between AI readiness and both gender as well as teaching experience and age were no longer statistically significant. This finding underscores the central mediating role of digital competencies in AI readiness. In other words, differences in AI readiness attributed to gender, age, or teaching experience may largely reflect underlying disparities in digital skill levels rather than demographic effects.

Table 3. Descriptive statistics for AI readiness dimensions and key teacher characteristics

Variable	M	SD
AI readiness cognition	3.02	0.91
AI readiness ability	2.54	0.99
AI readiness vision	3.07	0.89
AI readiness ethics	2.96	0.90
AI readiness total scale	2.90	0.82
Digital skills	3.93	0.67
Perceived usefulness of digital media	3.93	0.82
Gender	1.40	0.50
Age	41.23	9.23
Teaching experience	16.45	9.01

Note(s): $N = 153$, M = mean, SD = standard deviation, Gender coded as 1 = female, 2 = male

Source(s): Authors' own work

Table 4. Pearson correlations between AI readiness dimensions and key teacher characteristics

Variable	1	2	3	4	5	6	7	8	9
1. AI readiness total score	–								
2. AI readiness cognition	0.900***	–							
3. AI readiness ability	0.809***	0.811***	–						
4. AI readiness vision	0.806***	0.700***	0.673***	–					
5. AI readiness ethics	0.868***	0.906***	0.899***	0.866***	–				
6. Digital skills	0.373***	0.511***	0.464***	0.400***	0.366***	–			
7. Perceived usefulness of digital media	0.401***	0.430***	0.480***	0.326***	0.360***	0.654***	–		
8. Gender	−0.154	−0.139	−0.128	−0.212**	−0.162*	−0.329***	−0.242**	–	
9. Age	−0.154	−0.174*	−0.176*	−0.194	−0.163	−0.209**	−0.242**	0.403***	–
10. Teaching experience	−0.154	−0.200**	−0.176*	−0.194	−0.162*	−0.209**	−0.242**	0.403***	0.923***

Note(s): Pearson correlation coefficients are reported. $p < 0.05$, $p < 0.01$, $p < 0.001$ (two-tailed)

Source(s): Authors' own work

4. Discussion

This study aimed to validate the German version of the AI Readiness Scale for Educators and to explore how various teacher characteristics - such as digital competencies, age, gender, and teaching experience - are associated with AI Readiness. The findings suggest that AI readiness is a multidimensional construct, with distinct but interrelated factors that shape educators' readiness to adopt AI in the classroom. Specifically, the results highlight the importance of digital competencies in determining how teachers perceive and engage with AI technologies.

The results of the Confirmatory Factor Analysis (CFA) confirm that the proposed four-factor model of AI Readiness, which includes Cognition, Ability, Vision, and Ethics, is a valid and reliable measure for assessing AI readiness in teachers. The good model fit indices and high factor loadings provide strong evidence that the scale accurately captures the key components of AI readiness, making it a useful tool for future research and practice. Discriminant validity analyses indicate that the four subscales generally measure distinct constructs, with only the Cognition - Ability pair showing a slightly higher overlap, which is theoretically plausible given their conceptual relatedness. Measurement invariance analyses further suggest that the scale assesses AI readiness consistently across gender and age groups. Importantly, the validation of this model was conducted on the German-language version of the AI Readiness Scale for Educators, broadening its applicability to educators in German-speaking regions and offering a reliable instrument for cross-cultural research and professional development programs.

4.1 AI readiness and digital competencies

One of the key findings of this study is the positive correlation between digital competencies and AI readiness. This highlights the critical role that digital skills play in educators' ability to integrate AI into their teaching practices. Teachers who possess higher digital skills and perceive digital media as useful for their work tend to exhibit stronger AI readiness across all four factors. This finding is consistent with previous research, which has demonstrated that digital competencies are a key enabler for technology adoption in education (Antonietti *et al.*, 2022). As AI technologies become increasingly integrated into educational contexts, it is essential for professional development programs to focus on enhancing teachers' digital competencies. The ability to effectively use digital tools not only facilitates the adoption of AI but also helps teachers better understand and engage with the broader implications of AI for teaching and learning.

Notably, when digital competencies were controlled for, previously significant associations between AI readiness and demographic variables such as gender, age, and teaching experience became non-significant. This underscores the central role of digital skills: rather than reflecting inherent demographic differences, disparities in AI readiness appear to stem largely from different levels of digital competencies. We will elaborate on this in the next paragraphs.

4.2 Gender differences in AI readiness

Initial analyses found that male teachers exhibited higher AI readiness compared to their female counterparts, particularly in the dimensions of Ability and Vision. However, this gender difference was no longer statistically significant once digital competencies were controlled for. This suggests that the gap may be driven more by differences in digital competences and confidence than by gender itself. Earlier studies have found that men often report greater confidence in using new technologies, possibly due to differences in exposure, self-efficacy, or social expectations (Gómez-Trigueros and Yáñez de Aldecoa, 2021; Guillén-Gámez and Rodríguez-Fernández, 2022). Our findings align with these broader societal trends, indicating that higher digital exposure and technological self-efficacy, rather than gender itself, shape AI readiness. Consequently, efforts to promote AI integration should focus on ensuring equitable access to digital skills development. Professional development programs, in particular, initiatives that support female educators in building digital skills and technological self-efficacy, may be especially effective in narrowing gender-related differences in AI readiness (Li, 2015).

4.3 The role of teaching experience and age for AI readiness

The initially found negative correlations between teaching experience and AI readiness suggest that more experienced teachers are less likely to be prepared for AI adoption in the classroom. Interestingly, among the individual dimensions of AI readiness, only Vision was not significantly related to teaching experience. This suggests that experienced educators still recognize the potential and relevance of AI but may feel less equipped in terms of knowledge or practical ability to implement it. In terms of age, initial analyses revealed that older teachers showed lower scores specifically in the Cognition dimension, pointing to possible challenges in acquiring or understanding AI-related concepts. This finding aligns with previous research suggesting that older educators may be more resistant to adopting new technologies due to established pedagogical routines and limited exposure to emerging digital tools (Lucas *et al.*, 2021).

However, as for gender, also these relationships lost statistical significance once digital competencies were controlled for, again underscoring the central role of digital skills in AI readiness. To address this, professional development efforts should prioritize not only AI-specific training but also the strengthening of basic digital competencies, particularly for senior educators. Initiatives such as mentoring programs, hands-on workshops, and peer learning opportunities could help build the necessary confidence and skills to engage with AI technologies (e.g. Hur, 2025; Schallert-Vallaster *et al.*, 2025). As Lucas *et al.* (2021) emphasize, the integration of AI in education is not solely about learning to use new tools but also involves a shift in mindset and pedagogical practice. Supporting educators through this transition is key to ensuring inclusive and effective AI adoption across all levels of experience and age.

4.4 Implications for practice

The findings of this study have important implications for the design of professional development programs aimed at fostering AI readiness among teachers. First, enhancing digital competencies should be a central focus of these programs, as teachers with higher digital skills are more likely to be prepared for AI adoption.

Furthermore, gender differences and the challenges faced by older and more experienced teachers highlight the need for targeted interventions. Given the rapid advancement of AI in education, programs should not only provide technical training but also consider the broader social and psychological factors that influence AI adoption. This includes the willingness to embrace change and to foster an innovative mindset that empowers educators to explore AI's potential in the classroom.

4.5 Strengths, limitations, and directions for future research

Despite the valuable insights this study provides, it is important to acknowledge both its strengths and limitations. A key strength is the validation of the German version of the AI Readiness Scale for Educators, offering a reliable and psychometrically sound tool for assessing AI readiness in German-speaking educational contexts. The strong model fit indices and high internal consistency confirm the robustness of the instrument. Additionally, by identifying significant correlations between AI readiness and demographic and individual factors such as digital competencies, gender, age, and teaching experience, the study contributes to a deeper understanding of the factors influencing educators' preparedness for AI integration. These findings provide useful insights for policymakers and educational institutions in designing targeted professional development programs.

However, some limitations must be acknowledged. The relatively small sample size (N = 153) of German-speaking teachers in Switzerland limits the generalizability of the findings to other educational contexts and falls below conservative rule-of-thumb thresholds for CFA (Wolf *et al.*, 2013). Still, the stability of the CFA model was supported by both high factor loadings (0.601–0.880) and a Monte-Carlo simulation, which demonstrated reliable recovery of factor loadings and covariances, and excellent average model fit, indicating that the sample was adequate for validating the four-factor structure of the AI Readiness Scale. Additionally, the reliance on self-reported data introduces the potential for biases, such as social desirability bias and self-perception errors. Another limiting factor is that contextual factors such as school infrastructure, access to digital resources, or prior exposure to AI technologies were not explicitly assessed, which may have influenced the results. Future research could strengthen these findings by incorporating larger, more diverse samples, objective assessments of digital competencies, and relevant contextual variables. Furthermore, as this study is cross-sectional, it cannot establish causal relationships between AI readiness and influencing factors. Longitudinal studies would be beneficial in tracking changes over time and identifying causal mechanisms.

To build on these findings, future research should focus on expanding the study to include educators from diverse educational systems, allowing for cross-cultural comparisons of AI readiness. Investigating interventions designed to enhance AI readiness, such as targeted training programs, would provide actionable recommendations for improving professional development. Additionally, qualitative research, such as interviews and focus groups, could offer deeper insights into teachers' experiences, challenges, and needs regarding AI adoption. Finally, longitudinal studies tracking AI readiness over time could provide valuable information on how educators adapt to AI technologies and what strategies are most effective in supporting their development.

5. Conclusion

This study successfully validated the German version of the AI Readiness Scale for Educators, confirming its reliability and validity as an effective tool for assessing educators' preparedness to integrate AI into their teaching practices. Further, the findings underscore the critical role of digital competencies in fostering AI readiness: After controlling for digital competencies, previously observed differences related to gender, age, and teaching experience were no longer statistically significant. This highlights the importance of targeted professional development programs that focus on strengthening digital competences together with AI-specific affordances across all educator groups - regardless of demographic background. Moving forward, continued research and the implementation of strategic measures can help ensure that all educators develop the competencies necessary to effectively integrate AI into their pedagogical practices, thereby advancing AI adoption across educational contexts.

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Appendix

Table A1. Original and translated items for AI readiness

	Original items	German items (translation)
Cognition	(CO1) I clearly understand the new role of teachers in the era of AI	(CO1) Ich verstehe deutlich die neue Rolle von Lehrer:innen im Zeitalter der Künstlichen Intelligenz
	(CO2) I can effectively balance the relationship between teachers and AI technologies	(CO2) Ich kann die Beziehung zwischen Lehrer: innen und KI-Technologien effektiv ausbalancieren
	(CO3) I understand how AI technologies are trained and function in education	(CO3) Ich weiss, wie KI-Technologien trainiert werden und im Bildungsbereich funktionieren
	(CO4) I can distinguish the functions and features of different AI tools and applications	(CO4) Ich kann die Funktionen und Merkmale verschiedener KI-Tools und -Anwendungen unterscheiden
	(CO5) I understand the importance of utilizing AI technologies for data collection, analysis, evaluation, and security in education in the era of AI	(CO5) Ich weiss, wie wichtig die Nutzung von KI-Technologien für die Datenerfassung, -analyse, -auswertung und -sicherheit im Bildungsbereich im Zeitalter der KI ist
Ability	(AB1) I can effectively integrate AI technologies into my classroom routines	(AB1) Ich kann KI-Technologien effektiv in meinen Unterrichtsalltag integrieren
	(AB2) I can design different teaching approaches based on different functions of AI technologies	(AB2) Ich kann verschiedene Lehransätze entwickeln, die auf unterschiedlichen Funktionen von KI-Technologien basieren
	(AB3) I can rationally use AI technologies to solve problems	(AB3) Ich kann KI-Technologien sinnvoll zur Lösung von Problemen einsetzen, die ich während des Unterrichtsprozesses entdeckt habe
	(AB4) Based on the visual and real-time feedback provided by AI technologies, I can improve my teaching in the next step	(AB4) Durch das visuelle und Echtzeit-Feedback, das KI-Technologien bieten, kann ich meinen Unterricht in einem nächsten Schritt verbessern
	(AB5) I can optimize and reorganize the teaching process with the help of AI technologies	(AB5) Ich kann den Unterrichtsprozess mit Hilfe von KI-Technologien optimieren und umgestalten
	(AB6) I can effectively discuss, share, and collaborate with other teachers on the use of AI technologies to jointly design high-quality teaching solutions	(AB6) Ich kann effektiv mit anderen Lehrkräften über den Einsatz von KI-Technologien diskutieren, mich mit ihnen austauschen und zusammenarbeiten, um gemeinsam hochwertige Unterrichtspraktiken zu entwickeln
Vision	(VI1) I understand the strengths and limitations of AI technologies	(VI1) Ich kenne die Stärken und Grenzen von KI-Technologien
	(VI2) I have my own unique thinking and views on how to improve and use AI technologies for education	(VI2) Ich habe meine eigenen Vorstellungen und Ansichten darüber, wie man KI-Technologien für den Bildungsbereich verbessern und nutzen kann
	(VI3) I foresee the opportunities and challenges that AI technologies entail for education	(VI3) Ich sehe die Chancen und Herausforderungen voraus, die KI-Technologien für den Bildungsbereich mit sich bringen
Ethics	(ET1) I understand the digital ethics that teachers should possess in the era of AI	(ET1) Ich verstehe die digitale Ethik, die Lehrer: innen im Zeitalter der KI mitbringen sollten
	(ET2) I understand the ethical obligations and responsibilities teachers need to assume in the process of using AI technologies	(ET2) Ich kenne die ethischen Verpflichtungen und die Verantwortung, die Lehrer:innen bei der Nutzung von KI-Technologien übernehmen sollten
	(ET3) I know how to keep personal information safe when using AI technologies	(ET3) Ich weiss, wie man persönliche Daten bei der Verwendung von KI-Technologien richtig schützt
	(ET4) I use the data of teachers and students generated by AI systems following legal and ethical norms	(ET4) Ich nutze die von KI-Systemen generierten Daten von Lehrer:innen und Schüler:innen unter Einhaltung rechtlicher und ethischer Grundsätze

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