MedienPädagogik
Zeitschrift für Theorie und Praxis der Medienbildung
www.medienpaed.com **ISSN 1424-3636**

Jahrbuch Medienpädagogik 23: Kommunikation und Medienpädagogik: Theorien, Praktiken und Perspektiven.
Herausgegeben von Jane Müller, Katrin Kreutz, Rudolf Kammerl, Mandy Schiefner-Rohs, Sven Kommer und Franziska Bellinger

Teachers' Epistemic Beliefs and Digital Competence

Examining the Mediating Role of Digital Learning Beliefs

Maximilian Sailer[1], Xinlei Sun[1], Julia Watzinger[1] und Detlef Urhahne[1]

[1] Universität Passau

Abstract

Recent research in media education has increasingly emphasized how teachers' epistemic beliefs and digital learning beliefs shape instructional practices and the development of teachers' digital competence. Drawing on survey data from 156 in-service and pre-service teachers in Germany, this study employed structural equation modeling (SEM) to examine the relationships among teachers' epistemic beliefs, digital learning beliefs, and digital competence. The results indicate that both epistemic beliefs and digital learning beliefs are significant positive predictors of teachers' digital competence. Furthermore, digital learning beliefs mediate the relationship between epistemic beliefs and digital competence. These findings suggest that teachers' enduring conceptions of knowledge are indirectly associated with the development of digital competence through their beliefs about digital media and digital learning.

Grounded in theoretical reasoning, this study developed and empirically tested a mediational model linking teachers' epistemic beliefs, digital learning beliefs, and digital competence. The findings were consistent with the hypothesized mediation relationships. Nevertheless, these results should be interpreted as preliminary, and

Sailer, Maximilian, Xinlei Sun, Julia Watzinger, und Detlef Urhahne. 2026. «Teachers' Epistemic Beliefs and Digital Competence. Examining the Mediating Role of Digital Learning Beliefs». *MedienPädagogik* (Jahrbuch Medienpädagogik 23): 105–131. https://doi.org/10.21240/mpaed/jb23/2026.07.27.X.

future research employing stronger causal designs is needed to further validate and refine the implications for teacher education and educational policy.

Epistemische Überzeugungen von Lehrkräften und digitale Kompetenz. Zur vermittelnden Rolle digitaler Lernüberzeugungen

Zusammenfassung

In der medienpädagogischen Forschung wird zunehmend betont, wie epistemische Überzeugungen und digitale Lernüberzeugungen von Lehrkräften deren Unterrichtspraxis sowie die Entwicklung ihrer digitalen Kompetenz prägen. Aufbauend auf Befragungsdaten von 156 Lehrkräften und Lehramtsstudierenden in Deutschland untersucht diese Studie mithilfe von Strukturgleichungsmodellen (SEM) die Zusammenhänge zwischen epistemischen Überzeugungen, digitalen Lernüberzeugungen und digitaler Kompetenz. Die Ergebnisse zeigen, dass sowohl epistemische Überzeugungen als auch digitale Lernüberzeugungen signifikante positive Prädiktoren der digitalen Kompetenz von Lehrkräften sind. Darüber hinaus vermitteln digitale Lernüberzeugungen die Beziehung zwischen epistemischen Überzeugungen und digitaler Kompetenz. Diese Befunde deuten darauf hin, dass grundlegende Vorstellungen von Wissen mit der Entwicklung digitaler Kompetenz indirekt in Zusammenhang stehen, indem sie die Überzeugungen von Lehrkräften über digitale Medien und digitales Lernen prägen.

Theoretisch fundiert wurde ein Mediationsmodell entwickelt und empirisch überprüft, das epistemische Überzeugungen, digitale Lernüberzeugungen und digitale Kompetenz miteinander verknüpft. Die Ergebnisse stützen die angenommenen Mediationsbeziehungen. Gleichwohl sollten die Befunde als vorläufig interpretiert werden. Zukünftige Forschung mit kausal stärkeren Designs ist erforderlich, um die Implikationen für Lehrerbildung und Bildungspolitik weiter zu überprüfen und zu präzisieren.

1. Introduction[1]

In the digital age, effective teaching increasingly depends on the strengthening of teachers' digital competence. Recent advances in technology have made the digital transformation of educational institutions increasingly unavoidable. The onset of the COVID-19 pandemic in early 2020 accelerated this transformation by forcing teaching and learning activities online, thereby exposing numerous shortcomings in digital instruction, such as teachers' unfamiliarity with digital technologies, low utilization of digital resources, and suboptimal instructional outcomes (Trust and Whalen 2020). To meet the growing demand for cultivating students' digital skills, teachers must develop not only strong digital competence but also well-founded digital learning beliefs.

Digital competence, as a core component of teachers' professional literacy in the information society, encompasses multiple dimensions including information seeking, communication and collaboration, content creation, and ethical awareness (Redecker and Punie 2017). To achieve these goals, teachers must first acquire the ability to use digital media effectively, as these skills are essential not only for the design and planning of classroom instruction but also for directly influencing students' digital skill development. Previous research has consistently demonstrated a close association between teachers' digital competence and their self-perceptions of that competence (Krumsvik 2014). For instance, according to the expectancy-value theory proposed by Wigfield and Eccles (2000), in addition to subjective value beliefs, individuals' self-assessment of their abilities serves as a significant predictor of their performance-related behaviors. Accordingly, teachers' self-evaluations of their digital competence during the process of teacher education can be viewed as an important predictor of their future digital competence.

Teachers' epistemic beliefs refer to their conceptions of the nature of knowledge and knowing, which are typically conceptualized as multidimensional constructs. These include beliefs about the certainty and complexity of knowledge, the sources of knowledge, and the criteria for justification. Such beliefs not only shape teachers' instructional orientations but also influence how they evaluate and utilize digital technologies

1 Maximilian Sailer und Xinlei Sun haben gleichermassen zu dieser Arbeit beigetragen und teilen sich die Erstautorenschaft.

in classroom practice (Hofer and Pintrich 1997; Chan and Elliott 2004). Prior studies suggest that teachers who endorse more complex, relativistic, and constructivist-oriented epistemic beliefs are more likely to adopt student-centered pedagogies and integrate digital instructional tools into their teaching (Pajares 1992).

At the same time, teachers' digital learning beliefs, conceptualized as a specific type of teaching-technology belief, refer to their evaluations of the pedagogical value of digital tools, their perceived ease of use and usefulness, perceived risks, and technology-related self-efficacy (Watson and Rockinson-Szapkiw 2021). Such beliefs have been identified as significant predictors of both technology adoption and the development of digital competence (Tondeur et al. 2017). Within conceptual models of teachers' digital competence, these technology-related beliefs are theorized to function as mediating mechanisms that link teachers' internal cognitive structures with their observable classroom practices (Tondeur et al. 2012).

This focus is also highly relevant to current debates in media education. As AI-supported learning environments, learning analytics, and other algorithmic educational technologies become more prominent, teachers are increasingly expected not only to use digital tools effectively, but also to evaluate their pedagogical value, interpret data-informed recommendations, and critically reflect on the assumptions and limitations embedded in such systems (Chen et al. 2020; Grájeda et al. 2024).

Critical scholarship on the datafication of education has emphasized that digital technologies do not merely support teaching, but also reshape how learning is measured, represented, and governed through data and automated processes (Grant 2022). In parallel, AI in education may support planning, feedback, and personalized learning, while at the same time raising concerns related to data privacy, algorithmic bias, and the changing role and agency of teachers in digitally mediated educational settings (Alfredo et al. 2024). Against this background, examining how teachers' epistemic beliefs and digital learning beliefs relate to digital competence appears particularly important, because these belief structures may shape how teachers understand, appropriate, and critically negotiate emerging AI- and data-driven forms of education.

Taken together, the existing literature supports a hypothesized belief-chain pathway in which teachers' epistemic beliefs are associated with their digital learning beliefs, which, in turn, show both direct and indirect

associations with the development of digital competence (Fives and Buehl 2011). However, empirical validation of this pathway remains limited, particularly in relation to systematic modeling and the formal testing of mediation effects. Clarifying the relationships and underlying mechanisms among teachers' epistemic beliefs, digital learning beliefs, and digital competence would thus make an important contribution to advancing the professionalization of teachers' digital competence.

2. Theoretical framework

2.1 *Digital competence*

With the rapid advancement of the information society and the continuous evolution of educational technology, digital competence has become a core literacy for learning, working, and living in the digital era. Although the term is defined differently across contexts, it is generally understood as a combination of knowledge, skills, attitudes, and awareness that enables individuals to use digital technologies effectively for purposes such as information retrieval, content creation, communication, problem-solving, and the critical and ethical use of digital resources (Ilomäki et al. 2014).

In the educational domain, teachers' digital competence refers to their ability to support student learning in digital environments, encompassing not only technical operational skills but also instructional design capabilities and ethical awareness (Hall et al. 2014). Beyond basic information search and communication skills, it includes creating and disseminating digital content, diagnosing and resolving technical issues, protecting data security and privacy, and making sound ethical judgments in complex educational contexts. Such capacities are widely recognized as essential indicators of teachers' readiness for future-oriented education.

Against the backdrop of digital transformation, scholars and policymakers have developed frameworks to clarify the scope of digital competence for educators. The Digital Competence Framework for Educators (DigCompEdu) specifies 22 competences across six domains (Redecker and Punie 2017), providing a shared reference for developing targeted skills. These dimensions underscore that digital competence extends beyond technical proficiency to encompass cognitive, social, and ethical dimensions.

Empirical studies suggest that the development of teachers' digital competence is shaped by multiple factors, including their technological beliefs, motivation, self-efficacy, institutional support, and epistemic beliefs (Tondeur et al. 2017). Teachers with more sophisticated epistemic beliefs tend to be more receptive to technological change and more inclined to integrate digital media to foster students' autonomous knowledge construction (Kim et al. 2013; Bice and Tang 2022). For instance, Kim et al. (2013) found that teachers who view knowledge as evolving and constructed are more likely to employ technology to promote student-centered learning. Likewise, Bice and Tang (2022) observed that teachers holding more constructivist epistemic beliefs engage more deeply in integrating digital tools to enhance student autonomy and knowledge construction.

In recent years, with the rise of artificial intelligence, data-driven learning, and remote education, research has increasingly examined how individuals demonstrate critical thinking, self-directed learning, ethical judgment, and collaborative innovation in complex digital environments. In this context, teachers with advanced epistemic beliefs are better positioned to embrace technological change and employ digital tools to promote students' independent and meaningful learning (Ilomäki et al. 2014; Redecker and Punie 2017). However, the mechanisms through which teachers' epistemic beliefs shape the development of digital competence, as well as their broader implications for teaching practice, remain underexplored. Addressing this gap holds substantial implications for advancing teacher education and informing educational policy.

2.2 *Epistemic beliefs*

Schommer (1990) conceptualized epistemic beliefs as individuals' implicit assumptions regarding the structure, certainty, and simplicity of knowledge, such as whether knowledge is fixed or evolving, certain or tentative, and simple or complex. As a fundamental component of cognitive structure, epistemic beliefs act as a cognitive filter in processes such as information processing, reasoning, and the selection of learning strategies (Schommer 1990). They guide individuals in interpreting environmental information and constructing their personal frameworks of knowledge.

Empirical studies have shown that teachers' epistemic beliefs are systematically related to their acceptance of technological tools, approaches

to assessment, and tendencies toward pedagogical innovation (Fives and Buehl 2016; Barnes et al. 2020). For example, Deng et al. (2014) found that teachers holding relativistic epistemic beliefs were more inclined to embrace constructivist pedagogy and to support students' autonomous knowledge construction. Celik et al. (2021) proposed an integrative model linking epistemic beliefs with purposes of social media use and examined their influence on new media literacy (digital competence). Their findings suggest that the ways individuals use social media can reshape their epistemic beliefs about information. More importantly, social media use and epistemic beliefs jointly affect new media literacy skills: interactive engagement with digital platforms enhances individuals' ability to evaluate information, thereby strengthening digital competence. These findings imply that when teachers engage with digital media in interactive and collaborative ways, their epistemic beliefs become more sophisticated and open, which in turn facilitates the development of digital literacy.

In sum, teachers' epistemic beliefs not only provide the cognitive foundation for instructional decision-making but also significantly shape their attitudes toward educational technology and their competence development. The focus of research has gradually shifted from macro-level philosophical perspectives to micro-level structural analyses, with epistemic beliefs increasingly examined in fields such as teacher education, assessment, and technology integration.

2.3 Digital learning beliefs

Digital learning beliefs specifically concern teachers' subjective views, attitudes, and evaluations regarding the use of digital technologies in teaching (Ding et al. 2019). As part of the broader belief system in teaching, digital learning beliefs follow the general psychological mechanisms of belief formation but are uniquely shaped by the rapid evolution of digital technologies and the dynamic educational environment.

For example, Speer and Eichler (2022) examined pre-service teachers' developmental trajectories of beliefs about digital tools (STACK) and digital feedback during seminar sessions. Their findings revealed that teachers' digital learning beliefs can be cultivated and influenced, and are strongly associated with their subsequent digital competence in classroom practice. In other words, teachers with stronger digital learning beliefs are more

likely to perceive digital tools as useful and beneficial, and consequently demonstrate a greater willingness to integrate them into their teaching. This suggests that strengthening teachers' digital learning beliefs can foster more positive attitudes toward digital media, thereby enhancing both their digital practices and overall competence.

However, the presence of positive beliefs alone does not guarantee successful digital integration. While teachers may hold favorable attitudes toward digital technologies and recognize their potential for enhancing teaching effectiveness and student engagement, empirical research consistently demonstrates that such beliefs do not automatically translate into effective classroom practices (Thurm 2018). In many cases, background constraints such as insufficient infrastructure, inadequate training, limited institutional support, or conflicting demands hinder teachers from effectively integrating technology, even when they are motivated. Moreover, negative beliefs, such as concerns about technology or doubts regarding one's own abilities, often serve as psychological barriers to meaningful digital integration.

Within the broader context of educational digital transformation, teachers' digital learning beliefs have thus been widely recognized as a critical factor influencing instructional practices. For example, Schäfer (2020) emphasized that beyond digital competence itself, teachers' beliefs about the use of digital media represent a "final barrier" to digital integration. At the school level, whether teachers accept and trust that digital media can enhance teaching may be more decisive than their possession of technical skills alone. Such beliefs can either facilitate the effective integration of digital tools or, conversely, form hidden obstacles to professional development and classroom innovation. Accordingly, deepening our understanding of, and actively shaping, teachers' digital learning beliefs is essential for enhancing their media literacy and pedagogical practices.

Linking epistemic beliefs and digital competence: the mediating role of digital learning beliefs

In recent years, research in media education has increasingly emphasized that teachers' beliefs about both knowledge and digital media shape their teaching practices and digital competence.

Classical models such as the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) provide important theoretical perspectives. TAM posits that teachers' beliefs about "ease of use" and "usefulness" determine their willingness to adopt technology (Antonietti et al. 2022), while TPB highlights the influence of attitudes, subjective norms, and perceived behavioral control on behavioral intentions (Ajzen 1991). The Technological Pedagogical Content Knowledge (TPACK) framework further integrates technological, pedagogical, and content knowledge as a lens for examining teachers' digital competence. However, empirical studies have revealed only weak associations between epistemic beliefs and TPACK dimensions (Acikgoz and Akman 2023). Media education theories also stress that teachers' sense of professional responsibility and their pedagogical skills in employing digital media are critical to fostering digital literacy in the classroom (Schäfer 2020; Schmitz et al. 2024).

Against this backdrop, digital learning beliefs can be conceptualized as a mediating construct linking epistemic beliefs to digital competence. Teachers with more sophisticated epistemic beliefs are more likely to appreciate the potential of digital technologies for active learning and knowledge construction (Deng et al. 2014), and, in turn, to develop higher levels of digital teaching competence (Scherer and Teo 2019; Tondeur et al. 2017). This mediating pathway resonates with Ajzen's (1991) Theory of Planned Behavior, which conceptualizes attitudes and perceived control as rooted in deeper belief systems, and with the integrative model of teacher beliefs proposed by Buehl and Beck (2014), which underscores the nested and contextual nature of beliefs.

Accordingly, this study addresses the following research questions:

1. To what extent do teachers' epistemic beliefs predict their digital learning beliefs?
2. To what extent do teachers' digital learning beliefs predict their digital competence?
3. To what extent do teachers' digital learning beliefs mediate the relationship between teachers' epistemic beliefs and their digital competence?

3. Method

3.1 *Sample*

The data collection took place between December 12, 2023, and July 12, 2024. A total of 174 in-service and pre-service teachers from five cities in Germany were invited to participate in the survey. The questionnaire assessed teachers' digital competence, their digital learning beliefs, and their epistemic beliefs, and additionally collected demographic information on age, gender, teaching status (in-service vs. pre-service), media education as a supplementary subject, school type, and teaching experience. After a preliminary screening of the responses for completeness and validity, 156 questionnaires were retained for analysis. The detailed demographic characteristics of the final sample are presented in Table 1.

Variable	Frequency	Percent
Age		
18–24	57	37%
25–29	16	10%
30–34	21	14%
35–40	17	11%
Over 40	45	29%
Gender		
Female	102	65%
Male	51	33%
Divers	1	1%
Prefer not to say	2	1%
Teaching status (in-service / pre-service)		
In-service teacher (currently employed as a teacher)	74	47%
Pre-service teacher (currently enrolled in a teacher education program)	63	40%
Other	19	12%

Variable	Frequency	Percent
Media education (supplementary subject / Ergänzungsfach)		
Currently enrolled in Media Education as a supplementary subject (not yet completed)	29	19 %
Not enrolled in Media Education as a supplementary subject	100	64 %
Completed Media Education supplementary subject and passed the state teaching examination (Staatsexamen)	27	17 %
School type		
Primary school (Grundschule)	32	21 %
Lower secondary school (Mittelschule)	29	19 %
Intermediate secondary school (Realschule)	32	21 %
College-preparatory secondary school (Gymnasium)	43	28 %
Special needs school (Förderschule)	5	3 %
Vocational schools (Berufliche Schulen)	12	8 %
Other school type	3	2 %
Teaching experience		
Novice teachers (< 1 year)	62	40 %
Early-career teachers (1–5 years)	22	14 %
Experienced teachers (> 5 years)	72	46 %

Tab. 1: Demographic characteristics of the sample (N = 156)

The sample consisted of 156 teachers, including both in-service and pre-service teachers. The majority of participants were female (approximately 65 %). Among them, 47 % were in-service teachers, 40 % were pre-service teachers currently enrolled in a teacher education program, and the remaining 12 % were classified as "other" (for example, individuals employed as temporary teachers while holding another primary occupation).

Participants represented a range of school types, including primary schools, lower and intermediate secondary schools, college-preparatory secondary schools, special needs schools, and vocational schools. They also

differed in their experience with media education, with some currently enrolled in Media Education as a supplementary subject (not yet completed) and others having completed the subject and passed the state teaching examination (Staatsexamen). While this diversity increased the breadth of professional backgrounds represented in the sample, it also introduced heterogeneity with regard to teaching experience, professional role, and prior exposure to digital media. In particular, the inclusion of both in-service and pre-service teachers may have combined participants with systematically different practical experiences and belief structures, which should be taken into account when interpreting the findings.

3.2 *Research design*

This study adopted a quantitative research design, using structural equation modeling (SEM) to examine whether teachers' epistemic beliefs are indirectly associated with their digital competence through their digital learning beliefs. Data were collected through a questionnaire survey, and the hypothesized model was specified and tested using confirmatory factor analysis (CFA) and mediation analysis. Consistent with the theoretical assumptions of relational pathways among the variables, the study employed a cross-sectional design.

3.3 *Measures*

3.3.1 *Digital competence scale*

The digital competence scale was developed by Rubach and Lazarides (2019), based on the strategic framework "Bildung in der digitalen Welt (Education in the Digital World)" published by the Kultusministerkonferenz [KMK] (2016; The Standing Conference of the Ministers of Education and Cultural Affairs). The scale was designed to assess the skills required for pre-service and in-service teachers to act competently in digital contexts. All items were rated on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Because the instrument relies on self-report items, it captures participants' self-assessed digital competence rather than objectively demonstrated competence.

In total, the instrument measures seven domains of digital competence:

1. Searching and Processing (Suchen und Verarbeiten), example item: I can identify and use relevant sources in digital environments based on my search interests.
2. Communication and Collaboration (Kommunizieren und Kollaborieren), example item: I select digital media appropriately according to the situation for targeted communication purposes.
3. Production and Presentation (Produzieren und Präsentieren), example item: I am familiar with several apps and programs and can use them according to specific needs.
4. Protection and Safe Operation (Schützen und sicher agieren), example item: I am aware of dangers and risks in digital environments and take them into account and reflect on them.
5. Problem-Solving and Action (Problemlösen und Handeln), example item: I can adapt digital environments and tools for personal use.
6. Analyzing and Reflecting (Analysieren und Reflektieren), example item: I can analyze the effects of media in the digital world and deal with them constructively.
7. Teaching and Implementation (Unterrichten und Implementieren), example item: I recognize the potential of using digital media for social integration and participation.

Cronbach's alpha was employed as an indicator to assess the internal consistency and overall reliability of the instruments. In general, scales with alpha coefficients above 0.90, 0.80, and 0.70 are regarded as indicating excellent, good, and acceptable reliability, respectively, whereas values below 0.70 suggest questionable reliability (Lance et al. 2006). Based on these established criteria, Cronbach's alpha was computed for each scale used in the present study.

The results showed that the overall Cronbach's alpha for the Digital Competence Scale was 0.872, indicating good internal consistency. At the subscale level, the alpha coefficients were as follows: Searching and Processing, 0.658; Communication and Collaboration, 0.799; Production and Presentation, 0.647; Protection and Safe Operation, 0.729; Problem-Solving and Action, 0.726; Analyzing and Reflecting, 0.683; and Teaching and Implementation, 0.784. Taken together, these results indicate that the

Digital Competence Scale demonstrated satisfactory and acceptable internal consistency across its dimensions.

3.3.2 *Digital learning beliefs scale*

The digital learning beliefs scale developed by Braun et al. (2022) was employed to assess the beliefs of both pre-service and in-service teachers regarding digital learning.

While the original instrument was developed with a six-point Likert scale, it was adapted in the present study to a five-point format for two reasons. First, the overall questionnaire predominantly employed five-point response formats. Harmonizing the response structure across scales was intended to reduce response-format switching and facilitate completion of the survey. This decision is supported by methodological research: Aybek and Toraman (2022), using an IRT approach, found that five response categories showed no clear disadvantage in reliability compared with seven categories while offering a simpler response process, and they explicitly recommended the use of five-point categories in scale development. In addition, an eye-tracking study by Chen et al. (2015) showed that scales with five to seven response options required the least cognitive effort, whereas six-point non-absolute rating scales performed least favorably among the response formats examined. Admittedly, this adaptation may have influenced response distributions and the psychometric properties of the scale. Nevertheless, given the importance of response-format consistency across the questionnaire and the practical advantages for survey administration and data handling, the adaptation was considered methodologically defensible in the present study.

The adapted scale comprises seven dimensions:

1. Motivation, example item: digital media motivate learners through a playful approach to content.
2. Innovation, example item: digital media promote self-directed learning.
3. Support for Students, example item: digital media make learning more accessible for students with physical impairments.
4. Skill Promotion, example item: digital media do not promote the competencies in students that are truly important.
5. Overload, example item: using digital learning in class puts me under pressure.

6. Health Risk, example item: I have concerns about potential health effects caused by Wi-Fi.
7. Cost, example item: The maintenance of devices and applications is too expensive.

Together, these dimensions provide a comprehensive assessment of preservice and in-service teachers' multidimensional beliefs about digital learning, capturing cognitive, affective, and behavioral dispositions.

Cronbach's alpha was calculated to assess the internal consistency of the Digital Learning Beliefs Scale. The overall coefficient was 0.938, indicating excellent internal consistency. At the subscale level, the alpha values were 0.815 for Motivation, 0.816 for Innovation, 0.794 for Support for Students, 0.837 for Skill Promotion, 0.874 for Overload, 0.853 for Health Risk, and 0.889 for Cost. Overall, these results indicate that the Digital Learning Beliefs Scale exhibits strong internal consistency and satisfactory reliability across all dimensions.

3.3.3 *Epistemic beliefs scale*

The epistemic beliefs scale was adapted from the Oldenburg Epistemic Beliefs Questionnaire (OLEQ), published by the Leibniz Institute for Psychology (ZPID) (Berding et al. 2018). The original instrument comprised five dimensions:

1. Structure (Struktur; knowledge structure), example item: Too many theories only make things more complicated.
2. Certainty (Sicherheit; certainty of knowledge), example item: Even if there are several possible solutions to a problem, one solution is always the best.
3. Control/Ability (Kontrolle/Fähigkeit; controllability of learning/learning ability), example item: A person's intellectual potential is determined at birth.
4. Source (Quelle; source of knowledge), example item: Most of what is written in textbooks can be trusted.
5. Speed (Geschwindigkeit; learning speed), example item: Even those who learn slowly can fully understand a topic.

The scale was initially specified with the dimensions retained in the revised OLEQ framework and was subsequently evaluated in the present sample using confirmatory factor analysis and reliability analyses prior to inclusion in the structural model. All items were rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Cronbach's alpha was computed to examine the internal consistency of the epistemic beliefs scale in the present sample. The preliminary reliability analysis indicated uneven performance across subdimensions, with alpha values of 0.788 for Structure, 0.782 for Control/Ability, 0.828 for Source, and 0.524 for Speed. The overall alpha of the initial scale specification was 0.644. Because the final measurement specification of the epistemic beliefs construct depended on the combined evaluation of reliability and CFA results, the revised scale used in the structural model is reported in the Results section.

3.4 *Statistical Analyses*

This study employed structural equation modeling (SEM) to examine the associations among teachers' epistemic beliefs, digital learning beliefs, and digital competence within a hypothesized mediation framework. Statistical analyses were conducted using SPSS 26.0 and Mplus 8.3. Following the recommendations of Kline (2016) in "Principles and Practice of Structural Equation Modeling", we report χ^2, CFI, TLI, RMSEA, and SRMR as model fit indices. Model fit was considered acceptable when CFI > 0.90, TLI > 0.90, RMSEA < 0.08, and SRMR < 0.08.

To further examine whether epistemic beliefs (EB) were associated with digital competence (DC) indirectly through digital learning beliefs (DLB), a bootstrapping procedure with 5,000 resamples was conducted to estimate the indirect effect. The model included three structural paths: EB → DLB, DLB → DC, and EB → DC. Based on these paths, the indirect association of EB with DC via DLB, as well as the remaining direct association between EB and DC, was evaluated within the estimated model.

Although a minimum sample size of 200 is often cited as a rule of thumb for SEM, methodological research has shown that sample size requirements depend on model characteristics rather than on a single universal cutoff. In particular, required sample sizes vary as a function of the number of indicators and latent variables, the size of factor loadings and structural paths,

and the extent of missing data. In the present study, the hypothesized model was comparatively parsimonious, comprising three latent constructs and a limited number of structural paths (Wolf et al. 2013). The final analyses were based on retained indicators that showed acceptable measurement performance, and no major missing-data problems were observed. Against this background, the sample size of N = 156 was considered methodologically defensible for estimating the specified model, while still requiring cautious interpretation of the resulting parameter estimates.

4. Results

Prior to conducting structural equation modeling (SEM), we performed confirmatory factor analyses (CFAs) for all scales to verify the adequacy of their measurement structures.

For the Digital Competence Scale, the factor loadings of all dimensions were within the acceptable range: Searching and Processing ($\lambda = 0.579$), Communication and Collaboration ($\lambda = 0.556$), Production and Presentation ($\lambda = 0.496$), Protection and Safe Operation ($\lambda = 0.610$), Problem-Solving and Action ($\lambda = 0.675$), Analyzing and Reflecting ($\lambda = 0.537$), and Teaching and Implementation ($\lambda = 0.584$).

The Digital Learning Beliefs Scale also demonstrated satisfactory factor loadings: Motivation ($\lambda = 0.639$), Innovation ($\lambda = 0.686$), Support for Students ($\lambda = 0.632$), Skill Promotion ($\lambda = 0.673$), Overload ($\lambda = 0.767$), Health Risk ($\lambda = 0.634$), and Cost ($\lambda = 0.725$).

For the Epistemic Beliefs Scale, reliability analyses indicated that the initial full-scale version of the epistemic beliefs measure showed limited internal consistency (Cronbach's $\alpha = 0.644$), with the weakest performance observed for the Speed dimension ($\alpha = 0.524$). This pattern was consistent with the CFA results, in which the Speed dimension showed a low and non-significant loading ($\lambda = 0.167$, $p = 0.067$). On this basis, the Speed dimension was excluded from subsequent analyses, and the internal consistency of the revised scale increased to Cronbach's $\alpha = 0.759$. Although this value remains below more stringent psychometric standards, it can be considered marginally acceptable for exploratory purposes, as supported by prior literature (Taber 2018; Tavakol and Dennick 2011). The structural model was therefore estimated using the revised version of the epistemic beliefs construct rather than the initial full scale.

The results indicated that the overall model demonstrated a good fit to the data. Specifically, the chi-square test yielded χ^2 (132) = 133.537, p = 0.127, χ^2 /df = 1.012, suggesting no significant discrepancy between the observed data and the hypothesized model. Other fit indices also supported the adequacy of the model: RMSEA = 0.031, 90 % CI [0.000, 0.053], SRMR = 0.052, CFI = 0.975, and TLI = 0.970. All indices met conventional thresholds, indicating that the specified model was statistically consistent with the observed data.

Regarding the measurement model, the observed indicators of all latent variables demonstrated satisfactory factor loadings. In the structural model, teachers' epistemic beliefs showed a significant positive association with their digital learning beliefs (β = 0.461, p < 0.001). Epistemic beliefs were also significantly associated with teachers' digital competence (β = 0.333, p = 0.002). Moreover, digital learning beliefs were also significantly associated with digital competence (β = 0.328, p = 0.002), thereby underscoring their critical role in fostering teachers' digital competence. More detailed information on the model estimates and structural relationships is presented in Figure 1.

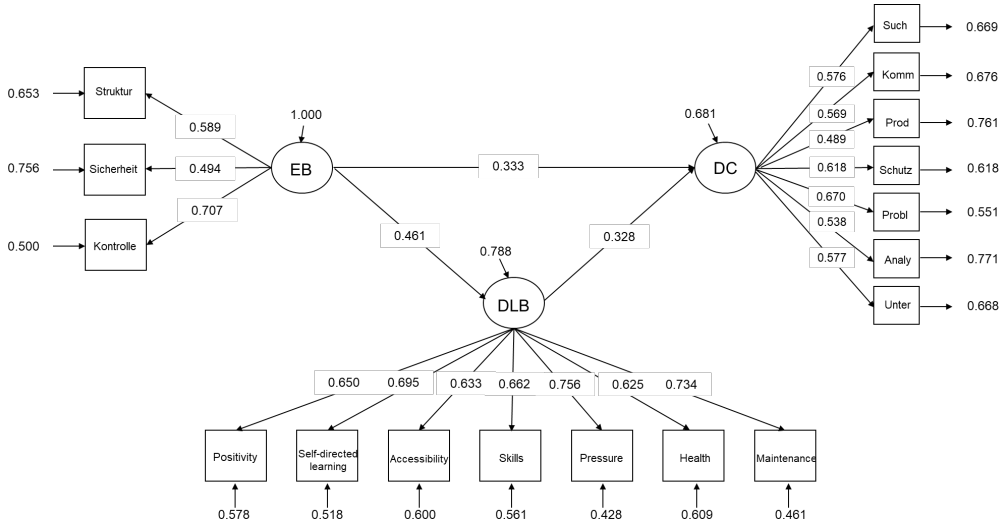

Fig. 1: Standardized path diagram of the structural equation model.

Note. EB, Epistemic beliefs; DLB, Digital learning beliefs; DC, Digital competence; Such, Suchen und Verarbeiten (Searching and Processing); Komm, Kommunizieren und Kollaborieren (Communication and Collaboration);

Prod, Produzieren und Präsentieren (Production and Presentation); Schutz, Schützen und sicher agieren (Protection and Safe Operation); Probl, Problemlösen und Handeln (Problem-Solving and Action); Analy, Analysieren und Reflektieren (Analyzing and Reflecting); Unter, Unterrichten und Implementieren (Teaching and Implementation).

As shown in Figure 1, the path from epistemic beliefs to digital learning beliefs (EB → DLB) was significant ($\beta = 0.461$, $p < 0.001$), as was the path from digital learning beliefs to digital competence (DLB → DC; $\beta = 0.328$, $p = 0.002$). The direct path from epistemic beliefs to digital competence (EB → DC) was also significant ($\beta = 0.333$, $p = 0.002$). The indirect effect of EB on DC via DLB was statistically significant ($\beta = 0.163$, $p = 0.022$), indicating that digital learning beliefs partially mediated the relationship between epistemic beliefs and digital competence.

The model accounted for 21 % of the variance in digital learning beliefs ($R^2 = 0.21$, $p = 0.012$) and 32 % of the variance in digital competence ($R^2 = 0.32$, $p < 0.001$). These proportions represent a moderate level of explanatory power, suggesting that the model captures a meaningful share of the variance in both the mediating and outcome variables. The detailed path coefficients are presented in Table 2.

Path	β	SE	p
EB → DLB	0.461	0.125	<0.001
EB → DC	0.333	0.111	0.002
DLB → DC	0.328	0.110	0.002
EB → DLB → DC (indirect effect)	0.163	0.071	0.022
EB → DC (total effect)	0.522	0.149	<0.001

Tab. 2: Results of mediation analysis: direct, indirect, and total effects.

5. Discussion

This study employed structural equation modeling to investigate the relationships among teachers' epistemic beliefs, digital learning beliefs, and digital competence. Overall, the findings were consistent with the assumption that epistemic beliefs, digital learning beliefs, and digital competence are systematically associated. More specifically, epistemic beliefs were positively associated with digital learning beliefs, and both constructs were

positively associated with digital competence in the present sample. In addition, the indirect association of epistemic beliefs with digital competence via digital learning beliefs was statistically significant, which is consistent with a pattern of partial mediation. These findings are discussed below in relation to existing research and in light of the methodological boundaries of the present study.

First, the significant association between epistemic beliefs and digital learning beliefs indicates that teachers with more sophisticated conceptions of knowledge are more inclined to recognize and value digital media in education. This finding is consistent with Ertmer's (2005) argument that core beliefs are closely related to technology-related beliefs. In the context of media education, such epistemic orientations encourage teachers to adopt student-centered, inquiry-based digital teaching strategies, thereby reinforcing their sense of responsibility for media education.

Second, epistemic beliefs were also significantly associated with digital competence in the present results, suggesting that conceptions of knowledge not only shape beliefs about digital learning but also independently contribute to the development of digital skills. A cross-sectional study of 198 in-service high school teachers in Germany found that teachers' metacognitive abilities were positively related to their epistemic beliefs, with higher-level epistemic beliefs enhancing self-efficacy in technology integration and, consequently, the effective use of digital tools (Thurm 2018). Similarly, Celik et al. (2021) demonstrated that epistemic beliefs are an important predictor of new media literacy, a core dimension of digital competence. In particular, justification-for-knowing beliefs were strongly associated with digital literacy, further substantiating the present findings. However, this result should be interpreted with particular caution. In the present study, digital competence was measured by self-report and therefore reflects participants' self-assessments of their digital competence rather than objectively demonstrated competence. The findings are more cautiously read as indicating that epistemic beliefs are related to how participants evaluate their own competence in dealing with digital media and digital teaching contexts.

This interpretive caution also applies to the association between digital learning beliefs and digital competence. Because both constructs were assessed through self-report questionnaires, the estimated relationship may partly reflect a broader positive orientation toward digital media and

one's own capabilities, rather than a purely behavioral or performance-based connection. Accordingly, the present result is better interpreted as an association between digital learning beliefs and self-reported digital competence than as evidence of a link to objectively demonstrated digital performance. The observed pattern is consistent with prior research suggesting that teachers who evaluate digital media more positively also tend to report higher levels of digital competence.

Third, the mediation analysis was consistent with the assumption that digital learning beliefs may function as an important intermediary construct between epistemic beliefs and digital competence. Conceptually, this interpretation is plausible because teachers' broader views about knowledge may be reflected in how they evaluate the educational usefulness, risks, and affordances of digital media. Schmitz et al. (2024), in a study of 2,247 Swiss secondary school teachers, found that only a minority of teachers actively addressed media literacy topics in their classrooms. Importantly, teachers' sense of responsibility ("I am responsible for teaching students media literacy") emerged as the strongest predictor of whether such topics were integrated into teaching. In other words, unless teachers recognize media education as part of their professional responsibility, they are unlikely to incorporate media literacy into their instructional practices. While technical skills (i. e., digital competence) matter, the decisive factor is teachers' willingness and responsibility orientation. This line of research suggests that teachers' beliefs about digital media may be relevant for whether and how media-literacy-related content is taken up in teaching.

Finally, the findings also resonate with evidence from Antonietti et al. (2022), who, within the framework of the Technology Acceptance Model (TAM), demonstrated that teachers' beliefs regarding the perceived ease of use and usefulness of technology directly enhance their self-assessed digital competence. This finding is broadly consistent with the present study's result that digital learning beliefs were positively associated with digital competence. Moreover, Peng et al. (2024), integrating the Will-Skill-Tool (WST) model with the TAM, reported a similar mediation pattern linking attitudes toward digital media to technology use. Taken together, these studies suggest that digital learning beliefs may represent an important intermediary construct in research on teachers' digital competence.

Taken together, the findings contribute to current media-education discussions by suggesting that teachers' orientations toward knowledge and

digital learning are relevant for understanding variation in self-reported digital competence. At the same time, the study should not be read as showing that epistemic beliefs or digital learning beliefs mechanically produce higher digital competence. Rather, the results indicate that these constructs are linked within the present sample and may jointly matter for how teachers position themselves toward digitally mediated teaching and learning.

6. Conclusion

This study investigated whether digital learning beliefs are statistically linked to the relationship between teachers' epistemic beliefs and digital competence. Based on survey data from 156 pre-service and in-service teachers in Germany, the findings were consistent with three main conclusions. First, epistemic beliefs were positively associated with digital learning beliefs. Second, digital learning beliefs were positively associated with self-reported digital competence. Third, the indirect association of epistemic beliefs with digital competence via digital learning beliefs was statistically significant, which is consistent with a pattern of partial mediation in the estimated model. Taken together, these findings provide preliminary support for the assumption that epistemic beliefs, digital learning beliefs, and digital competence are systematically related.

From a practical perspective, the findings suggest that teacher education may benefit from addressing not only technical aspects of digital teaching, but also teachers' broader beliefs about knowledge and digital learning. In this sense, the study offers empirical support for the view that reflective work on epistemic orientations and attitudes toward digital media may be relevant components of professional development in media education. At the same time, future research is needed to test these relationships with stronger designs and more differentiated measures.

7. Limitations

The present study has several limitations that should be considered when interpreting the findings. First, the study employed a cross-sectional design, which does not permit causal inference. Although structural equation modeling allows the estimation of theory-guided directional paths, cross-sectional data cannot establish temporal precedence; the observed

relationships should therefore be interpreted as associational rather than causal.

Another limitation concerns the measurement of epistemic beliefs. Although the weakest Speed dimension was removed prior to the structural analyses, the revised scale still showed only marginally acceptable internal consistency (Cronbach's α = 0.759). This limited reliability may have reduced measurement precision and the stability of associations involving epistemic beliefs. In addition, the epistemic beliefs instrument was adapted from a six-point to a five-point Likert format in order to align it with the other instruments used in the questionnaire. While this decision was methodologically defensible in the present survey context, it reduces the direct comparability of the findings with studies using the original scale format. A further measurement limitation concerns digital competence, which was assessed through self-report. The resulting measure therefore captures self-perceived digital competence and may overlap with technology-related self-efficacy beliefs, rather than reflecting objectively demonstrated competence alone.

Third, the sample also imposes important limits on interpretation. The pooled sample included both pre-service and in-service teachers, who may differ systematically in their epistemic beliefs, digital learning beliefs, and digital competence due to differences in professional experience and instructional context. Because the present study did not test measurement invariance or subgroup-specific models, potential between-group differences may have remained obscured. Moreover, the sample was restricted to participants from five cities in Germany, which limits the generalizability of the findings to other national, cultural, and institutional contexts.

Future research should address these limitations by using longitudinal or experimental designs, more robust and comparable measurement approaches, and larger as well as more differentiated samples.

References

Acikgoz, Bedriye, und Ozkan Akman. 2023. «The Relationship Between Epistemological Beliefs and Technological, Pedagogical, and Content Knowledge (TPACK)». *International Journal of Technology in Education* 6 (2): 326 – 348. https://doi.org/10.46328/ijte.425.

Ajzen, Icek. 1991. «The Theory of Planned Behavior». *Organizational Behavior and Human Decision Processes* 50 (2): 179 – 211. https://doi.org/10.1016/0749-5978(91)90020-t.

Alfredo, Riordan, Vanessa Echeverria, Yueqiao Jin, Lixiang Yan, Zachari Swiecki, Dragan Gašević, und Roberto Martinez-Maldonado. 2024. «Human-centred learning analytics and AI in education: A systematic literature review». *Computers and Education: Artificial Intelligence* 6: 100215. https://doi.org/10.1016/j.caeai.2024.100215.

Antonietti, Chiara, Alberto Cattaneo, und Francesca Amenduni. 2022. «Can Teachers' Digital Competence Influence Technology Acceptance in Vocational Education?» *Computers in Human Behavior* 132: 107266. https://doi.org/10.1016/j.chb.2022.107266.

Aybek, Eren Can, und Cetin Toraman. 2022. «How many response categories are sufficient for Likert type scales? An empirical study based on the Item Response Theory». *International Journal of Assessment Tools in Education* 9 (2): 534 – 547. https://doi.org/10.21449/ijate.1132931.

Barnes, Nicole, Helenrose Fives, Sirine Mabrouk-Hattab, und Kit SaizdeLaMora. 2020. «Teachers' Epistemic Cognition in Situ: Evidence from Classroom Assessment». *Contemporary Educational Psychology* 60: 101837. https://doi.org/10.1016/j.cedpsych.2020.101837.

Berding, Florian, Manuela Paechter, Karin Rebmann, Tobias Schlömer, Bettina Mokwinski, Yvonne Hanekamp, und Martin Arendasy. 2018. «OLEQ. Oldenburg Epistemic Beliefs Questionnaire [Verfahrensdokumentation und Fragebogen]». In *Open Test Archive*. Trier: ZPID. https://doi.org/10.23668/psycharchives.4519.

Bice, Holli, und Hengtao Tang. 2022. «Teachers' Beliefs and Practices of Technology Integration at a School for Students with Dyslexia: A Mixed Methods Study». *Education and Information Technologies* 27 (7): 10179 – 10205. https://doi.org/10.1007/s10639-022-11044-1.

Braun, Annika, Sabine Weiß, und Ewald Kiel. 2022. «Belief Patterns of Student Teachers About the Use of Digital Media in Teaching». *MediaEducation: Journal for Theory and Practice of Media Education*: 235 – 259. https://doi.org/10.21240/mpaed/00/2022.12.08.x.

Buehl, Michelle M., und Jeffrey S. Beck. 2014. «The Relationship between Teachers' Beliefs and Teachers' Practices». In *International Handbook of Research on Teachers' Beliefs*, herausgegeben von Helenrose Fives und Michele Gregoire Gill, 66 – 84. New York: Routledge. https://doi.org/10.4324/9780203108437-6.

Celik, Ismail, Hanni Muukkonen, und Selcuk Dogan. 2021. «A Model for Understanding New Media Literacy: Epistemological Beliefs and Social Media Use». *Library & Information Science Research* 43 (4): 101125. https://doi.org/10.1016/j.lisr.2021.101125.

Chan, Kwok Wai, und Robert G. Elliott. 2004. «Relational Analysis of Personal Epistemology and Conceptions About Teaching and Learning». *Teaching and Teacher Education* 20 (8): 817 – 831. https://doi.org/10.1016/j.tate.2004.09.002.

Chen, Xinxin, Hongyan Yu, und Fang Yu. 2015. «What is the optimal number of response alternatives for rating scales? From an information processing perspective». *Journal of Marketing Analytics* 3 (2): 69 – 78. https://doi.org/10.1057/jma.2015.4.

Chen, Xieling, Haoran Xie, Di Zou, und Gwo-Jen Hwang. 2020. «Application and Theory Gaps during the Rise of Artificial Intelligence in Education». *Computers and Education: Artificial Intelligence* 1: 100002. https://doi.org/10.1016/j.caeai.2020.100002.

Deng, Feng, Ching Sing Chai, Chin-Chung Tsai, und Min-Hsien Lee. 2014. «The Relationships among Chinese Practicing Teachers' Epistemic Beliefs, Pedagogical Beliefs and Their Beliefs About the Use of ICT». *Educational Technology & Society* 17 (2): 245 – 256. http://www.jstor.org/stable/jeductechsoci.17.2.245.

Ding, Ai-Chu Elisha, Anne Ottenbreit-Leftwich, Ya-Huei Lu, und Krista Glazewski. 2019. «EFL Teachers' Pedagogical Beliefs and Practices with Regard to Using Technology». *Journal of Digital Learning in Teacher Education* 35 (1): 20 – 39. https://doi.org/10.1080/21532974.2018.1537816.

Ertmer, Peggy A. 2005. «Teacher Pedagogical Beliefs: The Final Frontier in Our Quest for Technology Integration?» *Educational Technology Research and Development* 53 (4): 25 – 39. https://doi.org/10.1007/bf02504683.

Fives, Helenrose, und Michelle M. Buehl. 2011. «Spring Cleaning for the 'Messy' Construct of Teachers' Beliefs: What Are They? Which Have Been Examined? What Can They Tell Us?» In *APA Educational Psychology Handbook, Bd. 2: Individual Differences and Cultural and Contextual Factors*, herausgegeben von Karen R. Harris, Steve Graham, und Timothy C. Urdan, 471 – 499. American Psychological Association. https://doi.org/10.1037/13274-019.

Fives, Helenrose, und Michelle M. Buehl. 2016. «Teachers' Beliefs, in the Context of Policy Reform». *Policy Insights from the Behavioral and Brain Sciences* 3 (1): 114 – 121. https://doi.org/10.1177/2372732215623554.

Grant, Lyndsay. 2022. «Reconfiguring Education Through Data: How Data Practices Reconfigure Teacher Professionalism and Curriculum». In *New Perspectives in Critical Data Studies: The Ambivalences of Data Power*, herausgegeben von Andreas Hepp, Juliane Jarke, und Leif Kramp, 217 – 241. Cham: Springer International Publishing.

Grájeda, Adriana, Juan Burgos, Paola Córdova, und Andrés Sanjinés. 2024. «Assessing Student-Perceived Impact of Using Artificial Intelligence Tools: Construction of a Synthetic Index of Application in Higher Education». *Cogent Education* 11 (1): 2287917. https://doi.org/10.1080/2331186X.2023.2287917.

Hall, Richard, Lucy Atkins, und Josie Fraser. 2014. «Defining a Self-evaluation Digital Literacy Framework for Secondary Educators: The DigiLit Leicester Project». *Research in Learning Technology* 22: 21440. https://doi.org/10.3402/rlt.v22.21440.

Hofer, Barbara K., und Paul R. Pintrich. 1997. «The Development of Epistemological Theories: Beliefs About Knowledge and Knowing and Their Relation to Learning». *Review of Educational Research* 67 (1): 88 – 140. https://doi.org/10.3102/00346543067001088.

Ilomäki, Liisa, Sami Paavola, Minna Lakkala, und Anna Kantosalo. 2014. «Digital Competence – An Emergent Boundary Concept for Policy and Educational Research». *Education and Information Technologies* 21 (3): 655 – 679. https://doi.org/10.1007/s10639-014-9346-4.

Kim, ChanMin, Min Kyu Kim, Chiajung Lee, J. Michael Spector, und Karen DeMeester. 2013. «Teacher Beliefs and Technology Integration». *Teaching and Teacher Education* 29: 76 – 85. https://doi.org/10.1016/j.tate.2012.08.005.

Kline, Rex B. 2016. *Principles and Practice of Structural Equation Modeling*. 4. Auflage. New York: The Guilford Press.

Krumsvik, Rune Johan. 2014. «Teacher Educators' Digital Competence». *Scandinavian Journal of Educational Research* 58 (3): 269 – 280. https://doi.org/10.1080/00313831.2012.726273.

Kultusministerkonferenz. 2016. *Bildung in der digitalen Welt: Strategie der Kultusministerkonferenz*. Beschluss der Kultusministerkonferenz, 8. Dezember. https://www.kmk.org/fileadmin/Dateien/veroeffentlichungen_beschluesse/2016/2016_12_08-Bildung-in-der-digitalen-Welt.pdf.

Lance, Charles E., Marcus M. Butts, und Lawrence C. Michels. 2006. «The Sources of Four Commonly Reported Cutoff Criteria: What Did They Really Say?» *Organizational Research Methods* 9: 202 – 220. https://doi.org/10.1177/1094428105284919.

Pajares, M. Frank. 1992. «Teachers' Beliefs and Educational Research: Cleaning up a Messy Construct». *Review of Educational Research* 62 (3): 307 – 332. https://doi.org/10.2307/1170741.

Peng, Ran, Rafiza Abdul Razak, und Siti Hajar Halili. 2024. «Exploring the Role of Attitudes, Self-efficacy, and Digital Competence in Influencing Teachers' Integration of ICT: A Partial Least Squares Structural Equation Modeling Study». *Heliyon* 10 (13): e34234. https://doi.org/10.1016/j.heliyon.2024.e34234.

Redecker, Christine, und Yves Punie. 2017. *European Framework for the Digital Competence of Educators: DigCompEdu*. Luxembourg: Publications Office of the European Union. https://data.europa.eu/doi/10.2760/159770.

Rubach, Charlott, und Rebecca Lazarides. 2019. «Eine Skala zur Selbsteinschätzung digitaler Kompetenzen bei Lehramtsstudierenden». *Zeitschrift für Bildungsforschung* 9 (3): 345 – 374. https://doi.org/10.1007/s35834-019-00248-0.

Schäfer, Daniela Knüsel. 2020. *Überzeugungen von Lehrpersonen zu digitalen Medien. Eine qualitative Untersuchung zu Entstehung, Bedingungsfaktoren und typenspezifischen Entwicklungsverläufen*. Bad Heilbrunn: Verlag Julius Klinkhardt. https://doi.org/10.35468/5826.

Scherer, Ronny, und Timothy Teo. 2019. «Unpacking Teachers' Intentions to Integrate Technology: A Meta-analysis». *Educational Research Review* 27: 90 – 109. https://doi.org/10.1016/j.edurev.2019.03.001.

Schmitz, Maria-Luisa, Tessa Consoli, Chiara Antonietti, Alberto Cattaneo, Philipp Gonon, und Dominik Petko. 2024. «Why Do Some Teachers Teach Media Literacy While Others Do Not? Exploring Predictors Along the "Will, Skill, Tool, Pedagogy" Model». *Computers in Human Behavior* 151: 108004. https://doi.org/10.1016/j.chb.2023.108004.

Schommer, Marlene. 1990. «Effects of Beliefs About the Nature of Knowledge on Comprehension». *Journal of Educational Psychology* 82 (3): 498 – 504. https://doi.org/10.1037/0022-0663.82.3.498.

Speer, Annabelle, und Andreas Eichler. 2022. «Developing Prospective Teachers' Beliefs About Digital Tools and Digital Feedback». *Mathematics* 10 (13): 2192. https://doi.org/10.3390/math10132192.

Taber, Keith S. 2018. «The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education». *Research in Science Education* 48 (6): 1273 – 1296. https://doi.org/10.1007/s11165-016-9602-2.

Tavakol, Mohsen, und Reg Dennick. 2011. «Making sense of Cronbach's alpha». *International Journal of Medical Education* 2: 53 – 55. https://doi.org/10.5116/ijme.4dfb.8dfd.

Thurm, Daniel. 2018. «Teacher Beliefs and Practice When Teaching with Technology: A Latent Profile Analysis». In *Uses of Technology in Primary and Secondary Mathematics Education: Tools, Topics and Trends*, herausgegeben von Luciana Ball, Paul Drijvers, Silke Ladel, Hans-Stefan Siller, Michal Tabach, und Christine Vale, 409 – 419. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-76575-4_25.

Tondeur, Jo, Johan van Braak, Guoyuan Sang, Joke Voogt, Petra Fisser, und Anne Ottenbreit-Leftwich. 2012. «Preparing Pre-service Teachers to Integrate Technology in Education: A Synthesis of Qualitative Evidence». *Computers & Education* 59 (1): 134 – 144. https://doi.org/10.1016/j.compedu.2011.10.009.

Tondeur, Jo, Johan van Braak, Peggy A. Ertmer, und Anne Ottenbreit-Leftwich. 2017. «Understanding the Relationship Between Teachers' Pedagogical Beliefs and Technology Use in Education: A Systematic Review of Qualitative Evidence». *Educational Technology Research and Development* 65 (3): 555 – 575. https://doi.org/10.1007/s11423-016-9481-2.

Trust, Torrey, und Jeromie Whalen. 2020. «Should Teachers Be Trained in Emergency Remote Teaching? Lessons Learned From the COVID-19 Pandemic». *Journal of Technology and Teacher Education* 28 (2): 189 – 199. https://doi.org/10.70725/307718pkpjuu.

Watson, Jessica Herring, und Amanda Rockinson-Szapkiw. 2021. «Predicting Pre-service Teachers' Intention to Use Technology-enabled Learning». *Computers & Education* 168: 104207. https://doi.org/10.1016/j.compedu.2021.104207.

Wigfield, Allan, und Jacquelynne S. Eccles. 2000. «Expectancy-Value Theory of Achievement Motivation». *Contemporary Educational Psychology* 25 (1): 68 – 81. https://doi.org/10.1006/ceps.1999.1015.

Wolf, Erika J., Kelly M. Harrington, Shaunna L. Clark, und Mark W. Miller. 2013. «Sample Size Requirements for Structural Equation Models: An Evaluation of Power, Bias, and Solution Propriety». *Educational and Psychological Measurement* 73 (6): 913 – 934. https://doi.org/10.1177/0013164413495237.