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Professional Development of Secondary School Teachers Through Digital Pedagogy: The Mediating Role of Technological Competence

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Abstract

An explanatory sequential mixed-methods research design was adopted to explore the association between secondary school teachers' use of digital pedagogy and their professional development, with technological competence as a mediator. The first quantitative phase involved a sample of 210 secondary school teachers from both the public and private sectors in Lahore, Pakistan. The sample completed a modified survey that measured the intersection of digital pedagogy, technological competence, and professional development. The second, qualitative phase incorporated semi-structured interviews with an additional sample of 8 secondary school teachers to explain the quantitative findings. From the quantitative analyses, a strong, positive relationship was found between practicing digital pedagogy and professional development ($r = .842$, $p < .001$). It was found that technological competence fully mediated this relationship, accounting for 38% of the total effect. Furthermore, the professional development of secondary school teachers was positively influenced by the use of adaptive learning technologies, digital collaboration tools, and data-driven pedagogy. These findings were echoed in the qualitative phase of the study, which indicated that the use of digital tools in educational settings is strongly related to the refinement of teachers' pedagogical reasoning, professional collaboration, and reflective practice.

Keywords: Secondary School Teachers, Professional Development, Digital Pedagogy, Technological Competence, Adaptive Learning Platforms, Digital Collaboration, Data-Driven Instruction, Lived Experiences, Technology Integration, Reflective Practice.



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Introduction

Today's secondary school teachers are expected to be tech-savvy and flexible in their pedagogy (Howard et al., 2021). It is now a professional imperative that teachers use digital pedagogy to give their students opportunities to learn through a variety of technological means (Falloon, 2020). Digital pedagogy enables teachers to adapt their teaching methods and leverage technology to improve students' learning outcomes. Secondary school teachers also need to have regular exposure to digital pedagogy through (1) adaptive learning technologies, (2) digital collaboration technologies, and (3) data-driven teaching practices (Trust & Whalen, 2020). The framework consists of digital tools, collaborative networking, and research-based planning and instruction. However, due to the constraints of this study, only three areas have been addressed.

The focus of this research is on the digital pedagogy of secondary school teachers in both the public and private sectors of Lahore. The aim is to identify gaps in their professional development in relation to their technological competence. This is in line with learners' needs and the adaptive nature of pedagogy and teachers' professional development (Moorhouse & Wong, 2022). Digital pedagogy practices offer a research-based framework for teaching and learning that enhances professional development in the field (Fernández-Batanero et al., 2022).

Engagement with adaptive learning technologies enables educators to consider their teaching approaches alongside their learners' specific behavior and performance trends. Feedback generated by platforms also helps educators sustain a data-informed approach to their students' learning trajectories (Holstein, Starkey & Wright, 2018). Adarkwah (2021) indicates that the extended scope of learning analytics has a significant bearing on pedagogy. Educators may reconsider the strategies they have employed and adjust their instructional practices based on insights offered by the platforms (Bond et al., 2020).

The accumulation of digital learning records enables educators to consistently monitor student performance, and, as a result, teaching practices become increasingly refined (Ifenthaler & Yau, 2020). Performance data reveal the educator's sustained efforts to improve learning outcomes. Recording digital learning engagements offers secondary school educators opportunities for professional growth (Sailer et al., 2021). Based on learning management system performance data, identifying personal growth areas allows educators to engage in an important aspect of their professional development: personalization of growth, through the abandonment of previously established practices for new approaches aligned to the performance data of the learners, in a sustained dual growth framework (Scherer et al., 2019).

Secondary education is a pivotal period for adolescents, who undergo many social, emotional, and cognitive changes. Teachers in secondary education must, therefore, be equipped to facilitate advanced learning through proper integration of technology (Ertmer et al., 2012). Teachers and learners will have a range of opportunities for digital reflection, beginning with data-informed reflection, enabling them to upload and share experiences that have shaped their views on teaching. Digital pedagogy is likely to be contentious and highly context- and system-specific in terms of available resources; nevertheless, the practice enriches teachers' professional development and teaching practice.

Literature Review

Digital integration has been an intentional focus of many teaching programs. For example, self-documentation of digital learning and self-assessment on an online platform highlights opportunities for reflection that allow the process of development to continue (Koehler, 2014). Teachers' use of digital resources increases as their critical reflection develops. There is strong

alignment between the development cycle and critical thinking and the replacement of unconstructive practices with digitally informed practices in the field of secondary education (Tondeur et al., 2017). The integration of reflection, the development of action plans, and the implementation of documented digital activities influence teachers' use of technology at the secondary level (Scherer et al., 2021).

Digital pedagogy has been, and can be, a framework for further development of knowledge, skills, and attitudes for secondary school teachers in the presence of technology. It is crucial that Digital Pedagogy is part of all professional learning frameworks, including training of new teachers, professional development workshops, and any tertiary that secondary school teachers engage in to improve their skills (Voogt et al., 2013). The Digital Pedagogy framework (Mishra & Koehler, 2006) has been a starting place for understanding the interaction of technology and teaching in secondary education.

Mezirow's concept (2015) of critical reflection can also be adapted to digital contexts. It can be described as a developmental continuum, with the first stage being reflection on the practical elements of digitally enhanced teaching and learning. It then encompasses critical reflection on digital practices and information, comprehension of mediated online views, and, finally, the reconstruction of one's beliefs about teaching and learning. This is the ability of practitioners to make decisions and carry out digitally enhanced actions throughout their daily practice. This kind of reflection sharpens practitioners' knowledge and skills in integrating technology into their practice and helps them make more informed decisions in their daily work.

Digital pedagogy empowers practitioners and educational leaders to overcome the limitations of traditional frameworks for assessing the quality of teaching and learning (Fullan & Langworthy, 2014). These frameworks tend to shift according to the context, place, and time. By maintaining the authentic indigenous context and appreciating students' mediated responses through technology, practitioners' ability and skills to engage meaningfully with students and cultivate critical thinking are enhanced, as are their personal and professional growth.

Digital integration strategies must be adapted based on students' developmental stage and discipline. Using the digital pedagogy framework for secondary schooling emphasized the importance of technology-based reflective practices for the professional growth of secondary school teachers. The secondary teaching practices framework (Lai & Bower, 2019) outlines the documented digital teaching practices framework to support refinement in teaching, add value, and capture digital traces to identify and interpret areas for enhancement to incorporate the documented digital teaching practices. Teachers can use the self-development approach to address the complexities of teaching and to reflectively analyze technology-enhanced daily interactions with students (Beauchamp, 2015). Knowing students' digital learning practices strengthens teachers' ability to engage them in more meaningful and constructive ways. Taken together, documented digital reflections on teaching practices and collaborative professional dialogue create a powerful, positive effect on secondary school teachers, leading to documented improvements in their practice.

Research Objectives

The objectives of the research were to:

1. Identify whether there is any relationship between secondary school teachers' professional development and their use of digital pedagogy practices.
2. Examine the mediating role of technological competence in the relationship between digital pedagogy practices and professional development among secondary school teachers.

3. Explore how professional development of secondary school teachers is enhanced through digital pedagogy practices.

Research Questions

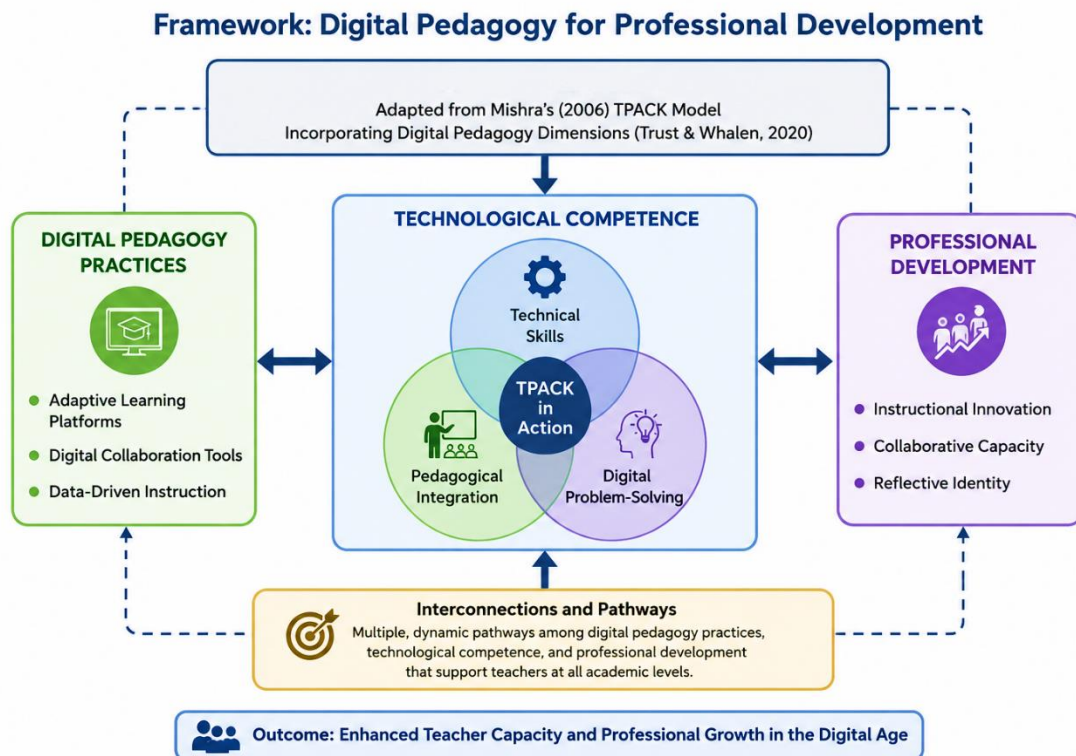
The following research questions were designed in alignment with the research objectives:

1. What is the relationship between digital pedagogy practices and professional development among secondary school teachers?
2. Does technological competence mediate the relationship between digital pedagogy practices and professional development?
3. How is professional development enhanced through digital pedagogy practices of secondary school teachers?

Conceptual Framework

The adaptation of Mishra's (2006) TPACK model for this study incorporates the dimensions of digital pedagogy described by Trust and Whalen (2020). The framework delineates multiple pathways for the professional development of teachers at all academic levels. This study focuses on 3 digital pedagogy practices within the contemporary digital pedagogy landscape. The pattern associated with the framework adapted for this study depicts the interconnections among secondary school teachers' digital pedagogy practices, their digital technology skills, and their professional development.

Figure 1: Framework: Digital Pedagogy for Professional Development



Research Methodology

A mixed-methods explanatory sequential approach was used to analyze the impact of secondary school teacher professional development programs on teachers' digital pedagogical practices,

with digital competence as a mediating variable. The initial phase involved distributing a survey to public and private secondary school teachers in Lahore, Pakistan. A two-stage cluster sampling procedure was employed. The first phase involved selecting a sample of 35 secondary schools, while the second phase involved surveys from an estimated 210 secondary school teachers. The survey was designed using existing frameworks for digital pedagogical practices (Trust & Whalen, 2020), digital competence (Scherer et al., 2019), and professional development outcomes. The selection of the teachers was based on the following criteria:

- Teachers with a minimum of 3–5 years of experience working in a secondary school setting.
- Teachers who had shown interest in digital pedagogical practices.
- Teachers who provided consent to participate in the study.

The survey consisted of three sections: 1) Digital Pedagogy Practices (DPP) in secondary education, which was made up of three digital pedagogy domains: i) Adaptive Learning Platforms (ALP); ii) Digital Collaboration Tools (DCT); iii) Data-Driven Instruction (DDI); 2) Technological Competence (TC); and 3) Professional Development (PD) in digital pedagogy. The results from teachers' digital pedagogy practices and technological competences revealed gaps in teachers' professional development opportunities in secondary education. The instrument demonstrated a good reliability value (Cronbach's $\alpha = 0.891$).

Once quantitative data were gathered, the researchers reached out to voluntary participants to conduct semi-structured interviews using a phenomenological interpretive voice approach. Eight participants were chosen based on sample size recommendations for the interpretative phenomenological voice. Interview questions were created and reviewed by two educational technology specialists.

To explore lived experiences, semi-structured interviews were conducted to understand the professional development opportunities that may be offered in light of digital pedagogy practices in secondary school teaching. The researcher obtained administrative approval to conduct interviews at the school. Participants were assured that their identities would be protected and that either a pseudonym or anonymous coding would be used.

Data Analysis and Interpretation

Data were analyzed using several techniques: descriptive statistics (mean and standard deviation), inferential statistics (correlation and regression), and mediation analysis using PROCESS macro in SPSS (Model 4). This analysis sought to understand the relationship between professional development and teachers' digital pedagogy practices, while also considering the mediation effect of technological competence.

To capture the qualitative analysis themes from the transcription, the following steps were undertaken:

The interpretive themes grounded in participants' lived experiences were coded using the phenomenological analysis framework of Smith and Fieldsend (2021). This analysis comprised three major steps: defining the themes, integrating them, and expounding their meaning.

- Facilitated the professional development of secondary school teachers via digital pedagogy by reviewing their transcriptions repeatedly.
- Built an understanding based on the context of the transcription.
- Discarded irrelevant and repeated views.
- Grouped the codes pertaining to the eight interviews. This grouping identified synergies among the lived experiences of secondary school teachers and led to the creation of a

thematic index.

Descriptive Statistics

Table 1: *Descriptive Statistics*

Variables	M	SD
Professional Development	4.12	2.68
Adaptive Learning Platforms	4.76	2.24
Digital Collaboration Tools	4.08	2.91
Data-Driven Instruction	4.81	2.13
Technological Competence	4.23	2.56

Findings indicate that secondary school teachers continue to develop professionally (PD; Mean = 4.12) by applying digital pedagogy in classroom teaching and learning practices. Pedagogy related to the use of adaptive learning (ALP; Mean = 4.76), digital collaborative (DCT; Mean = 4.08), and data-driven (DDI; Mean = 4.81) pedagogy practices provide secondary school teachers with opportunities for professional development. These practices reflect positive pedagogy. Results also revealed that the mean for technological competence was 4.23, indicating that participating teachers possessed a moderate-to-high level of competence in using technology.

Table 2: *Correlation Matrix between Digital Pedagogy Practices, Technological Competence, and Professional Development*

Variables	ALP	DCT	DDI	DPP	TC	PD
Adaptive Learning Platforms	1					
Digital Collaboration Tools	.968*	1				
Data-Driven Instruction	.782*	.775*	1			
Digital	.972*	.968*	.814*	1		

Variables	ALP	DCT	DDI	DPP	TC	PD
Pedagogy Practices	*	*	*			
Technological Competence	.845*	.838*	.796*	.849**	1	
Professional Development	.831*	.826*	.779*	.842**	.891*	1

Note: ** = $p < 0.01$; ALP: Adaptive Learning Platforms, DCT: Digital Collaboration Tools, DDI: Data-Driven Instruction, DPP: Digital Pedagogy Practices, TC: Technological Competence, PD: Professional Development

This study identifies the relationship between three aspects of teachers' digital pedagogy: adaptive learning platforms, digital collaboration tools, and data-driven instruction, and teachers' professional development in the context of secondary schools, focusing on the connection between teachers' digital pedagogy and the development and consistency of their professional practice. Table 2 depicts a strong positive correlation ($r = 0.972, 0.968, 0.814$) between secondary school teachers' digital pedagogy and professional development. Engaging with adaptive learning platforms, collaborative digital tools, and data-driven instruction reflects practices that support and promote professional development among secondary school teachers. Technological competence had a strong positive correlation with both digital pedagogy practices ($r = 0.849$) and professional development ($r = 0.891^{**}$), suggesting that it could serve as a mediator for both variables.

Table 3: Mediation Analysis Results

Effect	β	SE	T	p	LLCI	ULCI
Direct Effect (DPP → PD)	0.524	0.087	6.023	<.001	0.352	0.696
Indirect Effect (DPP → TC)	0.321	0.064	-	-	0.201	0.448

Effect	β	SE	T	p	LLCI	ULCI
→ PD)						
Total Effect	0.845	0.072	11.73 6	<.001	0.703	0.987

Note: Bootstrap samples = 5000; CI = 95% confidence interval

Results of the mediation study show that technological competence partially mediates the relationship between digital pedagogy practices and professional development. The indirect effect ($\beta = 0.321$, 95% CI [0.201, 0.448]) accounted for 38% of the total effect, suggesting that digital pedagogy practices have a direct effect on professional development; however, a considerable proportion of the effect is mediated by teachers' technological competence.

Thematic Interpretation of Lived Experiences

Interview transcripts facilitated the construction of thematic categories, while participants' responses yielded themes and subthemes. The following table presents these themes and subthemes along with a refined interpretation of participants' responses.

Table 4: Alignment of Digital Pedagogy Practices with Extracted Themes

Digital Pedagogy Practices		Extracted Themes of Professional Development
Adaptive Platforms	Learning	Adaptive Instructional Design
Digital Tools	Collaboration	Collaborative Digital Learning Communities
Data-Driven Instruction		Evidence-Informed Pedagogical Adjustments

Adaptive Instructional Design

The use of adaptive learning systems significantly alters instructional planning, enabling teachers to create more differentiated learning experiences. Instruction adjusted based on real-time learner data provides a means to unlearn the practice of doing the same thing for all learners and to learn new differentiated practices. The use of digital pedagogy-based systems for professional development enables secondary teachers to improve their adaptive instructional design skills.

Participant C shares:

Participant C stated the following:

"My use of adaptive learning systems has completely altered the way I go about planning the lessons I teach. I begin by examining data on student performance and identify the most critical

gaps to fill. I have to be flexible in how I go about my teaching, and this is important for me in my career as a secondary math teacher."

The participant clearly understood the importance of selecting adaptive systems for digital pedagogy practices. This also allowed the teacher to consider the quality of teaching and its impact on the professional development of the teacher and the students in secondary education.

Participant A states:

"Integrating Adaptive Learning technologies into my practice has sharpened my critical lens in relation to my teaching decisions. By constantly studying the data that the platforms provide, I can now teach with more purpose to a greater range of the needs of my students, even within the same classroom."

Through adaptive learning platforms, the teacher was able to build a data-informed practice that used reflective data to clarify teaching beliefs and the actions that stem from those beliefs to teach. This sustained and purposeful practice shows clear evidence of personalization to practice. This is a true reflection of expert growth, empowering the individual to think critically about their practice and stretch their thinking to new horizons, enhancing and refining their teaching practice.

Collaborative Digital Learning Communities

The structure and participation of networks for digital collaboration builds clarity in the growth of teaching practice. The more consistent and systematic teachers' engagement in digital professional learning communities, the greater the impact on teaching practice. The teaching of secondary education demands that teachers stretch their practice to support their professional growth and development (Prenger et al., 2021).

Digital documentation of teachers' professional dialogue is, at a minimum, necessary to evidence collaborative practice.

Participant Z says:

"Using digital collaboration tools lets me reflect critically on my teaching with colleagues from various schools. Compared to the isolated teaching I've done in the past, these interactions have a significant impact on my planning, appraisal, and teaching style."

Participant S states:

"Capitalizing on digitally mediated observations and resources has me reflecting more on collaborative documentation of effective practices. It has me acting more professionally when I display my teaching methods and when I engage in professional discourse with colleagues on practice in a structured and evidence-informed way."

Digital collaboration helps an individual teacher improve and enables a department or an organization to identify areas that require structural improvement, from planning to assessment development. From improvement-oriented collective practice, the feedback given on collaborative inquiry offers framework conditions for pedagogical improvement that can only be applied if all practice is surveyed and the outcomes discussed in the desire to improve collectively and grow professionally singularly.

Evidence-Informed Pedagogical Adjustments

Evidence of student learning must be collected, synthesized, and analyzed to develop practice. Learning can be manifested digitally in the classroom and in students' homes. Students can be taught using data. Working with data as a team enhances teacher professional practice and helps

them engage constructively with evidence. Systematically analyzing student data promotes professional practice.

Participant W states:

"Using analysis of multiple data sources, I learn different methods for facilitating student learning. Data analysis coupled with reflection develops my practice and highlights areas of growth for me as a secondary educator."

Participant B states:

"An important aspect of my development is the establishment of systematic data collection and analysis. The variability I see in my students' performance helps me to form diverse instructional strategies to meet students' varied learning needs."

Teachers who routinely engage with data on student learning are more likely to understand the impact of their teaching. This data analysis within the context of teaching practice brings other challenges to the fore and constitutes genuine professional development, as teachers learn within one context and transfer that learning to other relevant contexts.

Quantitative Analysis and Qualitative Results Integration

Table 5: *Quantitative and Qualitative Results Integration*

Sr.No.	Digital Pedagogy Practices	β -value	Extracted Themes for Professional Development
01	Adaptive Learning Platforms	.831**	Adaptive Instructional Design
02	Digital Collaboration Tools	.826**	Collaborative Digital Learning Communities
03	Data-Driven Instruction	.779**	Evidence-Informed Pedagogical Adjustments

Note: **p < .001

Discussion

This research sought to understand the relationship between teachers' digital pedagogy and professional development with technology skills as a mediating variable. The findings show that when teachers use digital pedagogy in secondary school teaching, for example, through adaptive learning, digital collaboration, and data-driven instruction, they create opportunities for further professional development. Digital pedagogy in secondary school teaching offers teachers the opportunity to use technology in their teaching alongside their professional development. An aspect of professional development is the willingness to use data to inform and adjust oneself and one's practice.

The qualitative aspect of the research complements the quantitative findings, as robust use of teachers' digital pedagogy was strongly correlated with and improved the professional

development of secondary school teachers. The more teachers use digital techniques to build their instructional methods, the more they enhance their professional placement in secondary education. Digital pedagogy that includes adaptive learning, digital collaboration, and data-driven instruction comprises all three dimensions and is reliable and useful from a developmental standpoint.

Secondary education depends on the practice of close observation and interprofessional discourse across subject-teaching teams. This is necessary to develop an understanding of students' learning needs. This practice also strengthens and facilitates the improvement of instructional techniques and skills, as well as the development of a collaborative professional culture. The use of digital resources to document student learning provides evidence and records instructional improvement. This may lead a teacher to revise their instructional methodology. Data-informed self-assessment has the potential to develop pedagogical practice and thinking of secondary school teachers. Professional learning that does not rely on the external evaluation of practice becomes an opportunity for genuine improvement. When secondary school teachers engage in self-assessment of their practice and use the resulting data, it provides the impetus to implement digital pedagogical practices that focus on self-assessment of their instructional practice. These practices constitute a significant professional development opportunity for secondary school teachers.

The role of technological competence, as a construct in this study, aligns with the TPACK framework (Mishra & Koehler, 2006) and suggests that teaching digital pedagogy must be coupled with teacher professional development to enable its integration into their teaching. This offers a significant extension to existing research by suggesting that digital pedagogical practices and the integration of technology in digital pedagogy must be coupled with teacher professional development to enable the authentic integration of digital pedagogy.

Conclusion

Secondary school teachers need to know the potential impacts of technology integration on students' learning. Secondary school teachers have opportunities for professional growth when they use digital pedagogies. Technology is an important element in this context. Digital pedagogies used in the secondary school environment demonstrated a distinct professional development outcome, supported by both quantitative and qualitative data.

While there are many digital pedagogies, the focus of this study is limited to three: adaptive learning technologies, digital collaboration and digital data within the context of a digital learning environment. Digital pedagogies allow secondary school teachers to engage with a wider range of methods for capturing learning. The pedagogies capture student learning over time and highlight gaps that require instructional focus. A digital collaborative environment enables teachers to understand their students and the learning challenges they face that require instructional focus. Data analysis of one's own practice enables broader professional growth opportunities and a varied pace of growth based on the practitioner's perceived and expressed outcomes.

There is little doubt that secondary school digital pedagogies will enhance teachers' professional growth in their teaching and professional practice. Improved professional development outcomes are evident in the reflections from the teachers who participated in the research.

Recommendations

The research findings confirmed a positive correlation between secondary school teachers' use of digital pedagogical practices and their professional development, mediated by technological

competence. The digital pedagogy practices discussed can be integrated across various strata of the educational system, especially at the upper secondary school level. This is because adolescents require systematic monitoring of their abilities, behaviors, and learning traits. Digital pedagogy practices documented digitally have the potential to greatly help secondary school teachers improve learning outcomes. The research findings can be shared with secondary school teachers from both private and public educational systems to support their professional development. Professional development programs should foster the growth of secondary school teachers while addressing technological competence and digital pedagogy practices, as both aspects are interlinked.

References

- Adarkwah, M. A. (2021). An Outbreak of Online Learning in the COVID-19 Outbreak in Sub-Saharan Africa: Prospects and Challenges. *Online Submission*, 21(2), 1-10.
- Beauchamp, C. (2015). Reflection in teacher education: Issues emerging from a review of current literature. *Reflective practice*, 16(1), 123-141.
- Bond, M. (2021). Schools and emergency remote education during the COVID-19 pandemic: A living rapid systematic review. *Asian Journal of Distance Education*, 15(2), 191-247.
- Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & education*, 59(2), 423-435.
- Falloon, G. (2020). Using animated simulations to support young students' science learning. In *Learning from Animations in Science Education: Innovating in Semiotic and Educational Research* (pp. 103-130). Cham: Springer International Publishing.
- Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & García-Martínez, I. (2022). Digital competences for teacher professional development. Systematic review. *European journal of teacher education*, 45(4), 513-531.
- Fullan, M., & Langworthy, M. (2014). A rich seam: How new pedagogies find deep learning.
- Holstein, J., Starkey, K., & Wright, M. (2018). Strategy and narrative in higher education. *Strategic Organization*, 16(1), 61-91.
- Howard, J. L., Bureau, J., Guay, F., Chong, J. X., & Ryan, R. M. (2021). Student motivation and associated outcomes: A meta-analysis from self-determination theory. *Perspectives on Psychological Science*, 16(6), 1300-1323.
- Ifenthaler, D., & Yau, J. Y. K. (2020). Utilising learning analytics to support study success in higher education: a systematic review. *Educational technology research and development*, 68(4), 1961-1990.
- Koehler, D. (2014). The radical online: Individual radicalization processes and the role of the Internet. *Journal for Deradicalization*, (1), 116-134.
- Lai, J. W., & Bower, M. (2019). How is the use of technology in education evaluated? A systematic review. *Computers & Education*, 133, 27-42.
- Mezirow, J. (2015). Transformative learning. *Challenging educational theories*, 319.
- Mishra, P. (2019). Considering contextual knowledge: The TPACK diagram gets an upgrade. *Journal of digital learning in teacher education*, 35(2), 76-78.
- Moorhouse, B. L., & Wong, K. M. (2022). The COVID-19 Pandemic as a catalyst for teacher pedagogical and technological innovation and development: Teachers' perspectives. *Asia Pacific Journal of Education*, 42(sup1), 105-120.
- Sailer, M., Murböck, J., & Fischer, F. (2021). Digital learning in schools: What does it take beyond digital technology? *Teaching and Teacher Education*, 103, 103346.
- Scherer, R., Howard, S. K., Tondeur, J., & Siddiq, F. (2021). Profiling teachers' readiness for online teaching and learning in higher education: Who's ready? *Computers in human behavior*, 118, 106675.
- Scherer, R., Siddiq, F., & Tondeur, J. (2020). All the same or different? Revisiting measures of

- teachers' technology acceptance. *Computers & Education*, 143, 103656.
- Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (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.
- Trust, T., & Whalen, J. (2021). Emergency remote teaching with technology during the COVID-19 pandemic: Using the whole teacher lens to examine educator's experiences and insights. *Educational Media International*, 58(2), 145-160.
- Trust, T., & Whalen, J. (2021). Emergency remote teaching with technology during the COVID-19 pandemic: Using the whole teacher lens to examine educator's experiences and insights. *Educational Media International*, 58(2), 145-160.
- Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge—a review of the literature. *Journal of computer assisted learning*, 29(2), 109-121.