

Native, addict, innovator: young teachers' digital competence in the post-COVID-19 instructional era

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Abstract

Purpose – The COVID-19 pandemic, in addition to posing challenges, has also created opportunities for greater digital integration than ever. However, the scale and efficacy of digital integration are contingent on the digital competence (DC) of teachers. In the same way, how well teachers learn and teach online may depend on how willing they are to try new ways of digitizing learning or being innovative. This study aimed to ascertain if teachers' digital nativeness, digital addiction and innovative work behavior had an impact on their DC.

Design/methodology/approach – The study used a quantitative research method, whereby data were collected from 276 schools, colleges and university teachers. The researchers employed structural equation modeling (SEM) using SmartPLS to analyze the data.

Findings – The results illuminate the literature regarding DC and the predictive capability of teachers' digital nativeness, digital addiction and innovative work behavior, which can contribute to paving the way for digitizing teaching and learning in the post-COVID-19 era.

Research limitations/implications – The study has significant implications for meaningful learner engagement by explaining the importance of teachers' digital competencies and how they could be approached conceptually to better understand the factors associated with teachers' DC. The differences in DC between digital natives and digital emigrants remain one of the limitations that future research may address.

Practical implications – The results have policy level and practical implications for organizations to consider the value of young teachers in the integration of digital resources. It is also critical to encourage teachers' innovative behavior in the digitization of teaching by creating a supportive organizational environment.

Originality/value – The study remains valuable in the post-COVID-19 era, where educational institutes are revisiting the prospect of online learning as a parallel to in-person teaching. The results remain innovative and genuine and have not been explored in previous research, in particular in the post-COVID-19 era. The involvement of teachers from schools, colleges and universities makes the results more general, which all of them can equally benefit from.

Keywords Digital native, Digital addict, Digital competence, Innovative work behaviour, COVID-19, Teachers
Paper type Research paper



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Introduction

In the aftermath of the COVID-19 pandemic, digitization in education has gained global recognition as an essential educational pathway. In this context, more than ever, teachers' digital competence (DC) remains decisive in the innovative and meaningful integration of digital resources in teaching and learning (Marusic and Viskovic, 2018). Teachers' DC seems to be associated with their exposure to, understanding of, and innovative use of digital resources in line with their instructional requirements (Xie, 2022). The young teachers, or "digital natives" (DNs) (Prensky, 2001), due to their frequent use of digital resources, may have enhanced their understanding of the instructional use of digital resources (Jomezai *et al.*, 2021).

For these digital natives to be able to use digital resources effectively in their teaching, they need to be able to and believe in their ability to do so (Smith *et al.*, 2020). This belief has been referred to as DC (Calvani *et al.*, 2012). DC, according to Marusic and Viskovic (2018), reflects teachers' ability to use digital technologies in a critical, collaborative, and creative manner, along with possessing the requisite knowledge, skills, and dispositions to be viewed as competent in the domain. Pettersson (2018) suggests that teachers' DC is not only something for the individual teacher to take responsibility for but should be seen as part of the teachers' digital environments and daily lives. The nexus of the relevant environment and DC requires DC to be viewed from various perspectives, such as personal behavior (Jomezai *et al.*, 2021) and environmental perspective (Ismail *et al.*, 2020). All these factors, according to Bandura (2006), are integral to influencing human learning behavior and practices.

Teachers' pace and decisions, as well as learners' styles and needs (Beasley and Beck, 2017), are what lead to the effective digitization of learning (Pulham and Graham, 2018). These serve as substantive and key competencies in the digitization of learning (Gilbert *et al.*, 2020). Teachers' use of innovative digital resources is paramount for students' active engagement in learning as it allows for a variety of teaching strategies (Barell, 2006). Their innovative work behavior towards the use of digital resources remains their prominent capability in addressing their instructional DC (Catio, 2019; Koehler and Mishra, 2009). Innovative work behavior (IWB) is an emerging term that was first defined by Janssen (2000) as individual behavior that contributes to the initiation, presentation, and implementation of innovative ideas, products, or processes within the workplace, team, or organization. The nexus of digital competency and innovativeness remains more relevant in the context of rapid digital transformation, which makes learning institutions the starting point of society at large, and teachers play an important role (Devisakti and Muftahu, 2023). In knowledge-based societies where competition is intense, innovative behavior is regarded as critical for sustainability and success (Kontoghiorghes *et al.*, 2005). The uncertainties caused by the recent COVID-19 pandemic and its sustained effects (Steen and Brandsen, 2020) require teachers to be innovative to integrate digital tools in a more meaningful way (Xie, 2022), cope with the use of digital innovations and remain innovative to deal with the challenges (Liguori and Winkler, 2020) they confront while integrating them in their teaching (Kruszewska *et al.*, 2020). Within the environmental domain, a shift from digital immigrants to digital nativeness (Prensky, 2001) may greatly influence teachers' DC (Borg and Smith, 2018; Khairani, 2017; Wang *et al.*, 2014). Prensky's view of "digital natives" (DN), is that they have grown up with digital technology, while Teo (2016) sees them as native speakers of the language of technology. We may refer to young teachers as DN, as they possess sufficient prior knowledge and personal experiences with digital resources and their digital environment, which influence their DC towards integrating digital resources in their instruction (Göbel *et al.*, 2023). In the meantime, despite the logical connection of DN with their DC and IWB, this has been contested in the literature (Wilson *et al.*, 2020). The opponents refer to DN as a myth on the grounds that they prefer keeping connected with their friends and the world around them as their major goal, rather than always supporting their learning (Kirschner and De Bruyckere, 2017). Wang *et al.* (2019) consider DN to be digital addicts (DA) of technologies. Addiction in this context refers to uncontrollable habits or practices

reflected in the extreme integration of digital resources, such as the Internet (Al-Khani *et al.*, 2021), smartphones (Sahu *et al.*, 2019; Sohn *et al.*, 2019), and social media (Christakis, 2019).

It is possible that the record use of the Internet during the pandemic (Jogezai *et al.*, 2021) resulted in increased DA and, meanwhile, affected teachers DC. Research in the post-COVID-19 era remains limited in this regard (Masalimova *et al.*, 2022) and requires efforts to understand whether teachers' characteristics such as DA, DN, and IWB had any impacts on teachers' DC. Within the context of observable research gaps and the global progression towards digitalization in education, in which teachers play a pivotal role, there is a need to understand the attributes of young teachers that influence their DC. The purpose of this study was to gain understanding, contribute to the existing corpus of knowledge, and provide educational institutions with valuable insights into the influence of specific attributes possessed by young teachers, namely their DN, DA, and IWB, on their DC.

Theoretical background and hypothesis formation

Digital competence

DC is the capacity to integrate digital technology in a meaningful, collaborative, and inventive manner (Marusic and Viskovic, 2018). Teachers' DC, therefore, remains fundamental to effective instructional digital integration. The DC of teachers, as frontline implementers (Jenkins, 2020), is crucial in the era where online learning has become a new reality (Tzafilkou *et al.*, 2022). The rapid development of digital technologies, according to Huang *et al.* (2021), has influenced education equally as other sectors and has consequences for teachers who adopt those digital technologies in teaching and learning. Consequently, it requires teachers to have critical thinking, problem-solving, and communication capabilities to comprehend the purpose and process of integrating digital resources into instruction (Saavedra and Opfer, 2012).

Literature has used ICT literacy (Ainley *et al.*, 2008), digital literacy (Eshet-Alkalay, 2004), media literacy (Erstad, 2010), and digital skills (Zhong, 2011) to explain teachers' DC. Recent research on DC provides a critical analysis to further modify the concept. Iiomäki *et al.* (2016), for example, describe DC as the skills and knowledge that citizens need to take part in and contribute to a digitalized knowledge society. Along the same lines, Pettersson (2018) suggests that teachers' DC is not only something for the individual teacher to take responsibility for but should be seen as part of an organization's digitalization process. Likewise, Colás-Bravo *et al.* (2019) perceived DC in the context of understanding both the social and cultural aspects to make it more relevant and effective for students. It is precisely through social interaction that the teacher has the capacity to generate the ideal setting for learning using technology. That is why the nexus of the organizational digitization process and DC remains vital, requiring critical reflections on teachers' practices (Hatlevik and Christophersen, 2013) and innovativeness. This nexus of competency and innovativeness makes it more relevant in the context of rapid digital transformation, as it requires teachers to act outside the box and remain unconventional in their responses. The uncertainties caused by the COVID-19 pandemic and its sustained effects (Steen and Brandsen, 2020) require teachers to be more innovative than ever in order to have the potential to be imaginative and predictive to make teaching and learning more meaningful (Xie, 2022). Van der Spoel *et al.* (2020) discovered that teachers with an average level of ICT experience and capacity perceived online teaching as more positive, implying that teachers' prior competencies are more important.

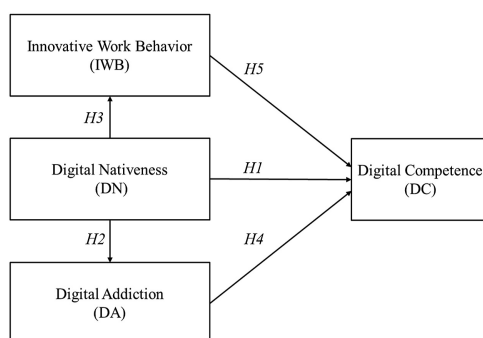
To be effective in using digital resources in instruction, teachers need to believe in their DC (Calvani *et al.*, 2012). Research considers knowledge and the desire to learn (Chou *et al.*, 2019; Wu *et al.*, 2022), perceived ease of use (Nair and Das, 2012), attitudes towards digital tools (Jogezai *et al.*, 2021), beliefs and the organizational environment (Chen *et al.*, 2021; Song *et al.*, 2014), and access to professional development programs and ICT resources (Ismail *et al.*, 2020) as the most prominent drivers of teachers DC. Literature has further categorized all these into external- and internal-level factors (Cattaneo *et al.*, 2021). The external-level factors comprise the available

ICT infrastructure at schools, teachers' professional development, school management support (Ismail *et al.*, 2020), and educational policies (Olofssona *et al.*, 2020), while teachers' attitudes, beliefs, competence, and job satisfaction are internal-level factors (Chen *et al.*, 2021). Adov and Mäeots (2021), after studying how teachers used technology during the COVID-19 pandemic, concluded that teachers' beliefs towards technology or their DC remain vital but rarely explored. In realization of the same, Tarrayo *et al.* (2023) consider teachers' capacity-building fundamental to meet teachers' DC in the COVID-19 pandemic era.

As an internal-level factor, the social environment also shapes value patterns and attitudes (Gardner *et al.*, 1993). The behavioral responses of young teachers, or DN, for example, demonstrate higher levels of competence than their more experienced counterparts (Cattaneo *et al.*, 2021; Fraillon *et al.*, 2014). Likewise, their IWB, as well as their sense of creativity or the ability to modify new ideas (Avsec and Ferik Savec, 2021), could help them become digitally capable and committed. The absence of internal factors, such as teachers' DC makes a significant difference to teachers' integration of digital resources in teaching and learning, even when external factors are present (Zhou *et al.*, 2020). Making the conditions supportive for effective ICT integration depends on unleashing these issues related to ICT integration (Yang Hansen *et al.*, 2020) and enabling them to integrate digital technology in a meaningful way (Mariën and Prodnik, 2014). Figure 1 illustrates the effects of DN, DA, and IWB on DC and also shows if DN affected teachers DA and IWB. The following sections entail the development of the study's hypotheses.

Digital natives

Prensky (2001) was the one who came up with the terms "digital natives" (DN) and "digital immigrants" (DI) to describe how people use and think about digital technologies. He stated that "digital natives" are people who have grown up with technology and that "digital immigrants" are people who were born before the advancement of IT or who have grown up with technology but are not ready to use it in the classroom right away. Oblinger and Oblinger (2005) argue that in a learning situation, natives are active and hands-on learners, are good at multitasking, and rely on communication technologies (like the Internet) to get information and communicate with others. The idea of DN and DI was appealing during the first decade of the 21st century. Later, the term DN was contested, with the claim that it could be perceived as more digitally literate (Yong *et al.*, 2016) or having sufficient technological knowledge (Koehler and Mishra, 2009). Furthermore, Hurwitz and Schmitt (2020) imply that simple access to technology without the development of appropriate digital skills can have a detrimental effect on academic outcomes.



Source(s): Author's own work

Figure 1. Study framework and hypotheses

Despite the difference in opinions, DN can benefit from the pace of online transformation (Chadwick *et al.*, 2022). The COVID-19 pandemic has pushed us to revisit the notion of DN and differentiate between those who are well-versed in technology and those who have had little exposure to it. The division between DN and DI is based on whether they have sufficient, minimal, or low interaction with digital technologies. DNs have been raised in a digital environment that has shaped how they think, behave, and act. Therefore, Gu *et al.* (2013) argue that the nature of technology usage and the acceptance of technology among digital natives and digital immigrants are presumably radically different. In this regard, Hürsen (2012) also found that younger teachers with less teaching experience remained more positive. In contrast to digital natives, digital emigrants may confront issues because of their age, and in the context of prevailing digital inequality, they may still have issues with access to digital resources and lack the capacity to use these tools in teaching and learning (Johnson *et al.*, 2023). The absence of an organizational-level supportive environment and access to digital resources (Gallagher *et al.*, 2019; Ismail *et al.*, 2020; Johnson *et al.*, 2023; Yu *et al.*, 2018) may confront them with further challenges. However, there is evidence that the pervasiveness of technology for multiple purposes in educational settings favors experienced and young teachers who demonstrate explicit characteristics of digital nativity, as suggested by Huang *et al.* (2021).

A recent review of the literature by Chadwick *et al.* (2022) found that online transformation helped those who already knew how to use digital tools. But they do not tell us how being born in the digital age affects their use of digital resources in their teaching and learning. Research in the post-COVID-19 era is limited to students' engagement as DN (Maini *et al.*, 2021) and leaves a research gap in understanding teachers' nativeness in relation to their DC. It is important to learn more to broaden our understanding of the relationship between a teacher's DN status and their DC. In light of the literature, we assume that the difference between technology adoption and usage among younger teachers who are DN, may have an effect on their digital capital. We have hypothesized the same as follows:

- H1. Teachers' digital nativeness can predict their DC.
- H2. Teachers' digital nativeness can predict their digital addiction.
- H3. Teachers' digital nativeness can predict their innovative work behavior.

Digital addicts

Beyond the notion of substance use, such as drug or alcohol addiction, uncontrollable habits or practices also fall into the territory of addiction (Harris *et al.*, 2014). In the age of technology, frequent users of digital resources such as the Internet, games (Kuss and Griffiths, 2012), and social media platforms (Andreassen *et al.*, 2012; Christakis, 2019; Marengo *et al.*, 2022) have been termed "digital addict" (DA). DA is a broad concept that includes addiction to computers, phones, games, and social networking (Kesici and Tunç, 2018; Sahu *et al.*, 2019; Sohn *et al.*, 2019). Undoubtedly, the COVID-19 and the distinctive rise of e-learning may have further triggered their use of the Internet (Jomezai *et al.*, 2021) and consequently increased exposure to screens, harming their mental and physical health (Seema *et al.*, 2022; Sohn *et al.*, 2019). However, with the rapid online transformation, more consumption in a virtual setting has become a compulsion for both teachers and students.

A recent meta-analysis by Johnson *et al.* (2023) on online teaching in K–12 education informs about two key aspects related to effective engagement in and learning online. Two crucial issues related to individuals' developmental capabilities are suggested to be considered: their experiences and their individualization and differentiation. They emphasize understanding and adapting to their level of autonomy in technology use and learning and on their self-regulated learning capabilities. This is due to a greater preference for online

learning and increased interaction with digital resources during COVID-19 (Vargo *et al.*, 2021), where learning spaces have been extended beyond schools, resulting in increased student autonomy and self-directed learning using technology. Consequently, they behave more as active participants in their learning than as information consumers (Basham and Marino, 2013). Research shows the greater impact of using digital resources in their learning as they feel more autonomous (Borup, 2016) and could effectively communicate, engage in learning, and feel accountable. However, the role of mentors and monitors was important (Curtis, 2013), as there is a significant difference between learners who use technology for active learning and those who simply utilize it to passively consume information, and some may be using it for leisure studies (Lepp *et al.*, 2014) or as DA (Kuss and Griffiths, 2012).

The majority of research has focused on students' addiction (e.g. Al-Khani *et al.*, 2021; Basham and Marino, 2013; Christakis, 2019; Johnson *et al.*, 2023; Sahu *et al.*, 2019; Sohn *et al.*, 2019) with little attention to teachers' digital addiction. The most recent research investigated teachers' phone addiction (Masalimova *et al.*, 2022), leaving a gap in understanding the association of teachers' digital addiction with DC. According to Karakose *et al.* (2022), the Covid-19 pandemic has made teachers more prone to Internet addiction to escape loneliness and remain joyful. Sarica and Özbay (2022) studying the effect of certain variables such as age, found no differences in the age of teachers DA on their digital skills. Awofala *et al.* (2020) claim that digital addiction leads to digital distraction, implying that teachers' DA is negatively associated with their DC. However, research also informs us about the positive relationship between DA and DN (Wang *et al.*, 2019). Based on the literature, we also assume that there is an effect of teachers' DA on their DC, and the following hypothesis has been formulated:

H4. Teachers' digital addiction can predict their DC.

Innovative work behavior

IWB is far more than individual creativity and is regarded as a process in which new ideas are created, implemented, and modified by humans to benefit role performance (de Jong and Den Hartog, 2007). Janssen (2000) defined innovative behavior as "the intentional creation, introduction, and application of new ideas within a work role, group, or organization in order to benefit role performance, the group, or the organization". For teachers, innovative behavior is the process in which they implement their creativity and solve difficult situations during their teaching, such as bringing forth, developing, applying, promoting, or modifying new ideas (Avsec and Ferik Savec, 2021).

The COVID-19 pandemic caused rapid changes in learning problems, and teachers had to come up with new ways to help students learn (Pokhrel and Chhetri, 2021). Learning from home was the ultimate response to overcome learning deficits, challenging teachers and schools to innovate solutions (Liguori and Winkler, 2020). As Dhawan (2020) mentions, the challenge provided an opportunity for teachers to be innovative in their teaching. Hammond *et al.* (2011), who conducted a meta-analysis on innovative behavior in different kinds of professions, concluded that their results support the notions (a) that individuals need some driving force to help them overcome challenges associated with creative and innovative work, (b) the importance of contextual and leadership influences in the creative process, and (c) that jobs may be redesigned to facilitate creativity and innovation at work by increasing complexity and autonomy, as well as by clearly requiring (and encouraging) creativity and innovation on the job (Hammond *et al.*, 2011, pp. 99, 101). The study of van der Spoel *et al.* (2020) found that the transition to online teaching has caused many teachers to reevaluate their methods of teaching while remaining innovative. The innovative application of technology has the potential to enhance the creative and interactive aspects of learning (Dhawan, 2020). In particular, the post-COVID-19 era has called for teachers to be more innovative as they switch to more digitization of teaching and learning (Hidayat and Patras, 2022; Yu *et al.*, 2021). However, there is little

known about the effectiveness of online teaching and learning as a result of teachers' IWB. Research has mostly considered innovative work behavior in relation to leadership capital (Chou *et al.*, 2019) and less about teachers' innovative behaviors that help influence their DC to better support students in the meaningful use of digital resources. Considering this research gap, we assume that teachers' IWB in the context of new instructional ideas (Wu *et al.*, 2022) has a phenomenal role in this regard and have formulated the following hypothesis:

H5. Teachers' innovative work behavior can predict their DC.

Method

We used a quantitative cross-sectional study (Kesmodel, 2018) to explain young teachers' DC in relation to the effects of their digital addiction, digital nativeness, and innovative work behavior. The study took place in Pakistan from June 2022 to January 2023.

The population of this quantitative study consisted of young teachers from schools, colleges, and universities in Pakistan born in or after 1980, from which data were collected using convenient sampling (Neuman, 2014). The study used a questionnaire as a data collection instrument that was sent through Google Docs to participants' email addresses and WhatsApp numbers. The questionnaire was made accessible to the participants based on their date of birth in or after 1980. The researchers obtained ethical approval from the Balochistan University of Information Technology and Management Sciences (BUIITEMS) prior to data collection, and participants were informed about the purpose of the study and their rights as research participants (Brody, 2001). Access to the survey was granted only after participants agreed to respond and indicated that they had read and understood the purpose of the study and their rights as study participants.

The data were then retrieved from Google Docs for analysis. To ensure the participation of young teachers, access to the survey was allowed to those born after 1980, mentioning their date of birth. A total of 281 teachers responded to the survey, of which five provided incomplete responses and were excluded, leaving 276 responses for analysis. We used descriptive statistics and structural equation (SEM) modeling (Hair *et al.*, 2017) to analyze the data collected through the questionnaire. SPSS was used for descriptive statistics to analyze participants' demographic data and Smart-PLS to analyze the data related to the effect of teachers' DA, DN, and IWB on their DC.

Table 1 illustrates the key characteristics of the participants in terms of their gender, teaching experiences, and qualifications. The research participants were 56.4% male and 43.46% female. In terms of the participants' teaching experience, the group with 6–10 years

Variables		Frequency	Percent
Gender	Male	156	56.52
	Female	120	43.48
Teaching experience	1–5 years	81	29.14
	6–10 years	120	43.48
	11–15	53	19.20
	16–20	21	7.61
	Above 20	03	1.09
Qualification	PhD	31	11.23
	MPhil	17	6.16
	Post graduation	101	36.59
	Graduation	127	46.01

Table 1.
Participants'
description

Source(s): Author's own work

made up the majority (43.48%), and the group with 1–5 years was the second highest (29.14%). The participants in the group 11–15 years made up 7.61% and above 20 years only 1.09%, respectively. Of the total participants, 46.01% were graduates, 36.59 were postgraduates, 11.23% were PhD, and 6.16% were MPhil. Participants' demographics provide a snapshot to understand their background in the context of this study and were not used for further analysis.

Measurement and instrument design

The study used four different data collection instruments (Table 2). These comprised the digital native assessment scale (DNAS) (Teo, 2013), the digital addict scale (DAS) (Seema et al., 2022), the innovative work behavior scale (IWB) (Jong and Kemp, 2003), and the DC scale (DCS) (Vuorikari, et al., 2016). All these instruments have been widely used with established validity parameters (Seema et al., 2022; Teo, 2016; Vuorikari et al., 2016). All the questionnaires were put into a single instrument by allotting each of the adopted questionnaires a section number in our instrument's design (Sections B1 to B3). DNAS was measured on a seven-point Likert scale, from 1 (very uncertain) to 7 (very confident), while the rest were measured on a five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). The demographic section (section A) of the questionnaire collected teachers' age, gender, length of service, and qualifications. The instruments also remained reliable, showing a Cronbach alpha in the range of 0.835–0.960 (Table 2).

Measurement model assessment

The measurement model aimed to evaluate convergent validity, reliability, and discriminant validity. As shown in Table 3 the overall item loadings remained in the range of above 0.50, as suggested by Hair et al. (2017). The composite reliability (CR) and the average variance extracted (AVE) also remained higher than 0.8 and 0.5, respectively. Similarly, the CR value in the range of 0.86 and 0.96 and the AVE between 0.56 and 0.72 meet the suggested threshold, thus establishing the reliability of the measurement of the model (Table 3).

The verification of discriminant validity involved using the heterotrait-monotrait (HTMT) ratio criterion, following the threshold value of 0.90 suggested by Henseler et al. (2009) and Henseler et al. (2014). As shown in Table 4, the values of HTMT were all lower than the strict criterion of 0.90. It shows that both the convergent and discriminant validity of the measurement model are confirmed in this study.

Structural model assessment

The propositions' statistical significance was tested by running boot-strap resampling (Henseler et al., 2009). The relationship of the structural model is determined by the path coefficient among the constructs of the study (Hair et al., 2017). Hypothesis testing (Table 5) supported H1, H3, and H5 with a significant impact; however, H2 and H4 were not supported.

Variable	Scale	No of items	Cronbach alpha	Source
Digital native	DNAS	21	0.949	Teo (2013)
Digital addict	DAS	10	0.920	Seema et al. (2022)
Innovative	IWB	08	0.835	Jong and Kemp (2003)
Digital competence	DCS	21	0.960	Vuorikari et al. (2016)

Source(s): Author's own work

Table 2.
Description of the
instruments

Construct	Indicator	Loadings	CR	AVE	P
Digital competence	DC-1	0.650	0.966	0.563	0.000
	DC-2	0.769			
	DC-3	0.775			
	DC-4	0.734			
	DC-5	0.699			
	DC-6	0.689			
	DC-7	0.824			
	DC-8	0.768			
	DC-9	0.753			
	DC-10	0.766			
	DC-11	0.885			
	DC-12	0.746			
	DC-13	0.633			
	DC-14	0.775			
	DC-15	0.759			
	DC-16	0.679			
	DC-17	0.756			
	DC-18	0.727			
	DC-19	0.793			
	DC-20	0.789			
	DC-21	0.745			
Digital natives	DN-1	0.890	0.989	0.709	0.000
	DN-2	0.887			
	DN-3	0.500			
	DN-4	0.882			
	DN-5	0.877			
	DN-6	0.603			
	DN-7	0.696			
	DN-8	0.543			
	DN-9	0.627			
	DN-10	0.898			
	DN-11	0.764			
	DN-12	0.704			
	DN-13	0.679			
	DN-14	0.511			
	DN-15	0.623			
	DN-16	0.849			
	DN-17	0.537			
	DN-18	0.827			
	DN-19	0.618			
	DN-20	0.640			
	DN-21	0.550			
Digital addicts	DA-1	0.625	0.932	0.727	0.000
	DA-2	0.860			
	DA-3	0.593			
	DA-4	0.811			
	DA-5	0.878			
	DA-6	0.857			
	DA-7	0.823			
	DA-8	0.877			
Innovative work behavior	IWB-1	0.689	0.863	0.508	0.000
	IWB-2	0.480			
	IWB-3	0.984			
	IWB-4	0.744			
	IWB-5	0.719			
	IWB-6	0.676			
	IWB-7	0.590			
	IWB-8	0.713			

Table 3.
Convergent validity

Source(s): Author's own work

The findings indicate that teachers' DN has a significant impact on DC ($\beta = 0.497, t = 13.289, p < 0.05$). The results indicate the hypothesis's acceptance and confirm that there is a significant effect of DN on DC. This shows that teachers with greater engagement and exposure to digital resources can implement digital technology in a meaningful, collaborative, and inventive manner. H2 evaluates whether DN has an effect on DA. The results do not support the hypothesis by showing that DN has no significant effect on DA ($\beta = 0.077, t = 0.896, p > 0.05$). These results indicate that the digital native status of teachers does not correlate with their digital addiction, i.e. they do not have uncontrollable behaviors or practices involving digital resources. They would rather utilize it productively. H3 evaluates whether DN has an impact on the IWB. The results remain significant in this regard ($\beta = 0.177, t = 4.149, p < 0.05$), hence the hypothesis was supported. It could be interpreted that the young teachers, or digital natives, are more innovative in relation to their DC or the meaningful and effective use of digital resources in teaching and learning. The results of H4, the effect of DA on DC was insignificant ($\beta = 0.052, t = 0.968, p > 0.05$) and did not support the hypothesis that there is a positive impact of DA on DC. H5 was also supported by the fact that IWB is capable of predicting DC ($\beta = 0.265, t = 7.329, p < 0.05$), which means that the more the teachers remain innovative in their approach towards digitization of learning, the more capability they have for the meaningful and effective integration of digital resources in teaching and learning.

Discussion

Teachers' DC (Calvani *et al.*, 2012) remains central to the successful integration of digital resources (Jenkins, 2020), especially in the rapid transformation in online learning (Huang *et al.*, 2021). This study aimed to understand the effects of DN, DA, and IWB on teachers' DC. The results inform us about the significant effects of DN and IWB on teachers' DC, while DA is ineffective. It refers to young teachers having more exposure to digital resources and gaining acceptance (Gu *et al.*, 2013), resulting in increased DC. These results support Chadwick *et al.*'s (2022) belief that the younger generation can better benefit from the pace of

	DA	DC	DN	IWB
Digital addicts-DA				
Digital competence-DC	0.076			
Digital native-DN	0.079	0.524		
Innovative work behavior-IWB	0.100	0.306	0.258	

Table 4. Discriminant validity using HTMT

Hypothesis	Path	Beta coefficient	Standard deviation	T statistics	p Values	Decision
H1	DN → DC	0.497	0.037	13.289	0.000	Supported
H2	DN → DA	0.077	0.072	0.896	0.371	No supported
H3	DN → IWB	0.177	0.039	4.149	0.000	Supported
H4	DA → DC	0.052	0.052	0.968	0.333	Not supported
H5	IWB → DC	0.265	0.036	7.329	0.000	Supported

Table 5. Path coefficient and hypothesis testing

Source(s): Author's own work

online transformation, compared to those with little exposure to digital technologies, because they are raised in a technology-friendly environment. Hürsen (2012) also found that younger teachers with less teaching experience remained more positive towards the digitization of learning. In contrast, as Johnson *et al.* (2023) allude, the older or digital immigrant teachers may have confronted issues at a young age, and in the context of prevailing digital inequality, they may still have issues with access to digital resources and lack the capacity to use these tools effectively in teaching and learning.

These young teachers with effective DC can be more active participants rather than just information consumers in their own learning (Basham and Marino, 2013) and can make a greater impact using digital resources in teaching and learning. However, there are many critiques of the concept of DN, and some term them DA (Kuss and Griffiths, 2012), while others inform about the positive relationship between DA and DN (Wang *et al.*, 2019). The results of this study, however, did not find any effect of DA on DC. In contrast, our results indicate a significant effect of DN on their DC. One of the key differences could be the focus of this research, as the literature mostly focused on students in the context of DN and DA (Curtis, 2013; Maini *et al.*, 2021). They mostly investigated how parents, as mentors and monitors, could help students make interaction with technological tools meaningful for learning rather than for leisure and fun (Kesici and Tunç, 2018; Sahu *et al.*, 2019; Lepp *et al.*, 2014). Teachers, as more responsible and autonomous professionals, have the capability to individualize learning, such as through pacing, choice, and accommodating learners' needs (Beasley and Beck, 2017), and more importantly, remain more innovative in using digital resources for teaching and learning (Dhawan, 2020; Koehler and Mishra, 2009). This is because they possess the skills of presentation and the implementation of innovative ideas, products, or processes within the workplace, team, or organization (Janssen, 2000).

This study also investigated teachers' IWB in relation to their DC, as rapid technological transformation and uncertainties caused by the COVID-19 pandemic and its sustained effects (Steen and Brandsen, 2020) required teachers to be innovative to integrate digital tools in a more meaningful way (Xie, 2022). Our results found a positive effect of teachers' IWB on their DC. Their greater IWB could remain central to the effective pedagogical application of DC by teachers to understand the variety of innovative digital practices, improve their own practices, and support their students (Zhou *et al.*, 2021) and colleagues (Andrews *et al.*, 2016). The results support the idea that integrating technology into teaching involves teachers' using innovative ideas and adopting innovative ways to integrate technology into their teaching (Chou *et al.*, 2019). Their innovativeness will remain a key to helping teachers keep up with the ever-changing society and the variety of learning technologies (Catio, 2019).

The study remained limited to understanding the DC of young teachers or DN without explaining the DC of experienced teachers or digital emigrants. Not exploring the difference between the DC of experienced and young teachers is one of the limitations of the study. Moreover, the differences in DA between young and experienced teachers remained unexplored. Gender as a key variable in the context of teachers' digital nativeness, DA, and IWB could be significant in explaining their DC, which is also one of the limitations of this study. Understanding the differences in DC between teachers' levels of education (school, college, and university) in relation to their DC would be interesting, but this study did not investigate it. These dimensions remain potential future research agendas.

Implications

This study provides significant insights about the predictors of teachers' DC. The most prominent is the effect of young teachers on their DC. The same has policy level and practical implications for organizations that should consider the value of young teachers in the integration of digital resources. This dimension has critical practical implications for

educational institutions considering young teachers' leading roles in initiatives related to the digitization of learning. It does not undermine the role of experienced or senior teachers, but rather enables institutes to have more options, engage the right person for the job, and foster collegiality and collaboration between senior and junior teachers. It is also critical to understand how to encourage teachers' innovative behavior in the digitization of teaching by creating an organization-based supportive environment and encouraging peer support and collaboration. In the present study, peer support means teachers sharing resources and experiences related to technology in teaching and encouraging those who encounter difficulties. Policy guidelines need to focus on providing spaces for young teachers to lead in the integration of digital resources. Colleagues can help each other overcome hardships and be more innovative. Teachers' information literacy is a comprehensive quality that demonstrates that they purposefully and reasonably use digital resources in teaching and learning. In a more practical sphere, the organizational environment, peer support, and information literacy have positive impacts on teachers' innovative behaviors, while excessive technostress, as Wu *et al.* (2022) also argue, will hinder teachers' IWB. However, there is evidence from this study and previous ones (e.g. Huang *et al.*, 2021) that the pervasiveness of technology for multiple purposes in educational settings results in experienced and young teachers who demonstrate explicit characteristics of DN. However, the dimension of the difference in DC between DN and digital emigrants remains one of the limitations that future research may address. The findings of this study also have considerable implications for educational leadership, particularly in the context of fostering a supportive climate that addresses the disparity between those with advanced digital skills and those who are less proficient. This is crucial to effectively implementing new pedagogical approaches that fully incorporate digital resources in a meaningful manner. Likewise, it is crucial for future studies to address the consequences of school leadership digital competency on teachers' digital capabilities.

Conclusions

This study provides significant insights about the predictors of teachers' DC. The most prominent is the effect of young teachers as DN, which has a significant effect on their DC. However, these DN, as portrayed by the available literature, do not mean to be DA, as shown by our results, which reveal no relationship between addicts and their DC. Innovative work behavior, integral to innovative and meaningful digital integration, also significantly predicted teachers' DC. We can conclude that the rapid digital transformation and the COVID-19 pandemic have confronted teachers with enormous challenges and opportunities at the same time. Successful ICT integration depends on teachers' responses in making their best use of digital capital to meet the challenges and make the most of the opportunity, as a lot has been contributed to the integration of digital resources in teaching and learning. They need to be innovative in their approach to integrating technology into teaching. Teachers' DC is imperative, but so is their capability of proposing innovative ideas and adopting innovative ways to integrate technology into teaching. If teachers lack DC and are not innovative, it may be difficult to meet the challenges brought by digital transformation.

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