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Psychological Preparedness of Teacher Trainees for Digital Education

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Abstract

The global phenomenon of digital education has prompted educational stakeholders worldwide to expedite the implementation of the concept, which was already gaining momentum before the COVID-19 pandemic. Despite various institutional summer training and workshops focused on the subject, field reports from universities reveal that the psychological preparedness for online education delivery among lecturer training students as well as elsewhere actually remains low. Such readiness is nonexistent in some cases, according to reflection journals and self-reports. Consequently, this study centers on teacher trainees' digital education preparedness, given that they will hold education job positions after graduation.

The rapid move to digital pedagogy and online education arising from the pandemic millions of students worldwide, many in difficult conditions. Entrenched local realities—such as geographic isolation, extreme poverty, unreliable access to electrical power and the internet, plummeting academic documents and other material resources—further exacerbated teaching and learning problems. Digital education in these instances cannot be viewed as a solution, since the viable components exist neither. Focusing on preparedness, advanced technological equipment for future employment needs and improvement of educational quality are equally considerable and pertinent. Digital connectedness—frequently referenced within the overall context of digital education—can be a false signifier in such situations; the terms being conflated becomes yet another matter of concern. Self-efficacy, readiness, identity and adaptation are relevant psychological components previously integrated into teaching and learning with technology. Other stakeholder dimensions are equally important yet overlooked. Consequently, users and items are defined before outlining psychological physical components of teacher-trainee readiness for digital education with technology. Preparedness involves potential individual, social and institutional shift. Preparation further entails teachers' willingness and motivation to assume vested authoritative roles and zero-centred power equations, engaging all actors in the learning and development process for personal, professional and social advancement. (Lembani et al., 2022)

Keywords: *Digital education, Online learning, Teacher readiness, Digital pedagogy, Self-efficacy, Technological adaptation, COVID-19 impact, Educational inequality*

1. Introduction

Digital education encompasses the application of Internet and digital technologies to create, fortify, and transform learning experiences. Within this landscape, teacher preparedness emerges as a vital criterion, defined as meeting established competence standards for teacher training aligned with digital learning environments. Teacher readiness relies on pedagogical knowledge and capabilities throughout initial education and, thus, builds upon pedagogical content knowledge—a prerequisite for the effective integration of digital methodologies into educational practice. The increasing use of digital technology in teaching coupled with the prevailing health crisis underscores the timeliness and importance of examining this construct among teacher trainees. Within SUBJECT, teacher education programs have incorporated digital pedagogy themes, offering insight into overall competence within this domain. Teacher readiness constitutes a distinct construct from general digital and media competence and currently lacks a theoretical foundation applicable to the teaching

profession within TARGET. In light of recent societal changes triggering both opportunities and challenges of significant magnitude, the overarching objective centres on examining the psychological preparedness of teacher trainees for digital education through the lens of the above-mentioned framework.

Teacher preparedness has emerged as a pivotal subject of debate globally, meriting investigation in advancement of digital education initiatives in tandem with the intensification of analysis and research surrounding education specified in the 2030 Agenda. Socioconstructivist theories propose that the learning of one individual primarily occurs through interaction and that collective knowledge generations ultimately contribute to each individual's knowledge development. Increased access to technology throughout society and the simultaneous availability of learning resources through diverse media necessitate an opening of pedagogical approaches, expert knowledge, and learning opportunities within teacher education. Teacher education—an essential foundation for individual development, generating opportunities to consider learning from multifaceted viewpoints, and galvanizing the curiosity to learn more—sustains pivotal significance regardless of feasible access to resources and content.

The focal inquiry investigates readiness for integrated teaching among prospective teachers trained in SUBJECT within INTERNET—targeting all prospective instructors engaged in science, mathematics, and technology courses. Specified nevertheless as integrated training involving a digital component within certain higher education institutions, teaching still generally ensues without connection of ideas targeting technological demands within the discipline or consideration for modalities, sequences, or scaffolding. Addressing gaps in available knowledge is essential for the advancement of higher education and greater social progress. Prospective teachers pursuing COURSES continue to receive support for learning through technological modalities, yet the initiation of teaching remains technically oriented, primarily directed at establishing presentations. Verifications of desired objectives still occur, yet the foundational intention is to facilitate teacher contestants in progressing toward desired motivations, thoughts, skills, competencies, capabilities, concern, and psychological characteristics that constitute readiness for digital training.

2. Theoretical foundations of digital education and teacher readiness

Emerging perspectives in educational theory reveal how digital technologies can foster both individual and collaborative learning in ways that enhance deep understanding, critical engagement, and creativity. In constructivist and socio-constructivist paradigms, learners create their own knowledge on the basis of personal experience in ways that are enhanced by appropriate digital media. Constructivism, in general, addresses the need for deeper learning and is based on scientific knowledge about the learning process. In particular, collaborative learning, knowledge building, and inquiry-based learning are emphasised. Digital technologies can facilitate collaborative learning by linking learners who are separated in time and place, and by providing tools for collaborative processes. Computer-mediated communication enables dialogue, debate, and discussion of solutions to ill-structured problems, fostering collaborative knowledge building and inquiry-based learning. The potential for collaboration through technology is compounded by the fact that it allows the collaboration to be visible for later reflection and feedback, helping teachers deal with large numbers of learners and time constraints at different locations (Brändle et al., 2023).

Many educators hold the misconception that learning through collaborative activities, digital media, and social media is a superficial fad or unimportant distraction that diverts attention from the 'real curriculum' of reading and writing. Such negativity can operate at the level of self-efficacy, identity, and resilience.

Self-efficacy refers to the beliefs that individuals hold about their capability to perform at desired levels within specific domains. Self-efficacy is a major influence upon performance, training, persistence in the face of challenges and obstacles, and continued professional growth. Teacher identity, particularly in digital contexts, operates from the concept of educator identity being constructed in terms of the physical, pedagogical, and content dimensions of teacher-student interactions. Identity construction can be facilitated by resistance, transition and trajectory. By contrast, the socio-technical nature of teacher identity underpinning the use of technology as an enabler of education operates at three interconnected levels, namely content knowledge, pedagogical knowledge, and technology knowledge.

Learner resilience and the use of adaptive coping strategies during times of rapid and intense change is an additional but critical dimension shaping readiness and preparation for the integration of digital technologies and resources into

educational practices. Resilience lies at the centre of adaptive coping approaches and continues to receive significant theoretical and practical attention. Stress arising from the evolving use of diverse and multifaceted digital technologies within educational environments can encounter, among other factors, insufficient time and interactive engagement with substantial and broad institutional support. Resilience is a pivotal determinant shaping the intended effects of stress in relation to job turnover intention, work-life balance, and the continuity and coherence of effective teaching and learning.

2.1. Constructivist and socio-constructivist perspectives

Teaching-learning processes are based on the adage "tell me and I will forget, teach me and I will remember, involve me and I will learn," which highlights the importance of participation. Learning is achieved through active involvement, whether individually or collectively, that leads to the construction of personal meanings. Constructivism contemplates an understanding of knowledge as a diverse and multifaceted phenomenon and a process of constructing personal knowledge on the basis of prior knowledge (Quadros Flores et al., 2017). Constructivism highlights the contribution of the social environment in influencing the reconstruction of knowledge. Therefore, social interaction and collaborative learning become very relevant for personal growth. The ideal learning scenario must allow for the exploration of the collaborative dimension of the constructivist theory. The socio-constructivist approach encourages a participatory culture and immerses students into a digital world where socialization and collaboration become the norm. Universities should encourage teacher-education programs to incorporate the exploration of competencies in these digital environments (Melnikova et al., 2018).

2.2. Self-efficacy and teacher identity in digital contexts

Digital technologies are transforming the learning environment and the profile of teachers: self-efficacy nurtures one's belief in his or her skills and ability to successfully perform certain tasks, whereas teacher identity reflects one's professional image and personal commitment to being a teacher (Baroudi & Shaya, 2022). Teacher preparation programs have traditionally focused on developing pedagogical knowledge and broadening instructional skills that strengthen elementary future teachers' self-efficacy and identity in a digital context when designing digital learning activities. The role of self-efficacy in the online context and the evolution of identity in relation to a teacher and to technology and environment.

2.3. Resilience and adaptive coping in technological change

Teachers are obliged to develop resilience and adaptive coping capacities to navigate technological change positively. Intelligent learning in response to such change is essential for creating adaptable work environments. Those acting intelligently with information and communications technology (ICT) demonstrate commitment to autonomous learning, which has revolutionized access to information for learners. The variety of available resources has changed teaching practices and activities outside the classroom. Generations Z and Alpha are deeply connected to digital technology, presenting challenges and opportunities for education. Teachers with different styles recognize the need for methodological changes required by ICT, especially for Generation Alpha, which shows a stronger interest in technology. However, ICT also creates difficulties; veteran teachers may feel overwhelmed, while novice teachers, having grown up digital, perceive less impact and benefit from digital fluency. These experiences highlight a generational divide, without clear consensus or framework yet established.

3. Dimensions of psychological preparedness for digital education

Psychological preparedness for digital education encompasses a range of motivational and emotional dimensions. Central aspects include the motivation and attitude toward technology integration, anxiety levels, cognitive load management, and the practice of metacognition (Quadros Flores et al., 2017).

The desire to enhance teaching practices through digital technology is one of the most important motivating factors influencing the integration of digital resources in pedagogical practice. This intrinsic motivation appears to be coupled with a favourable attitude toward the perceived value of technology in teaching and learning. Other intrinsic drivers include curiosity and the attractiveness of new technical products. At the same time, a certain level of extrinsic motivation exists, linked to elements such as the pressure perceived from academic and government authorities, the recommended integration of technology by peers, expectations from the educational institution, and the degree to which being technologically trained is regarded as a professional advantage. Different professional subject areas also slightly affect these motivational aspects (Brändle et al., 2023).

Feelings of anxiety are normal when faced with technological changes. New technologies are frequently perceived as threats, which creates concern about job insecurity, possible exclusion from the academic community, or the inability to exploit new digital opportunities. Such feelings may lead to digital fatigue, which negatively impacts engagement, attention, and learning outcomes. Maintaining a high level of motivation is essential for a successful shift toward digital education and the consequent establishment of effective pedagogical practices. Managing cognitive load and being aware of mental workload when planning, implementing, and reflecting on digital teaching practices are essential components of psychological preparedness for digital education. Identifying the cognitive processes involved in these educational practices and the overall cognitive load required to fulfil them are key factors that determine the adequacy of the instructional design. Plenty of strategic alternatives are available for reducing cognitive load and accommodating students having different cognitive capacities.

Another important dimension is the extent to which metacognition and reflective practice take part in the online learning experience. Engaging in self-regulated planning, monitoring, evaluation, and reflection, as well as making use of feedback in a continuous improvement loop contribute significantly to psychological preparation for the digital education environment. Considering formative evaluation at different stages of the implementation process assists in course enhancement and professional growth.

3.1. Motivation and attitudes toward technology integration

A teacher's motivation and attitudes toward technology integration are among the major factors influencing the degree of digital technology integration into education as perceived by teacher trainees. Typically, motivation is divided into intrinsic drivers (interest, enjoyment) and extrinsic drivers (compensation, status). Student teachers with higher intrinsic motivation to use educational technology find technology integration more meaningful, while further pedagogical knowledge, access to and support of resources, and freedom in implementing technological devices were identified as important conditions for teachers' extrinsic motivation to use educational technologies. Student teachers tended to perceive the importance of such educational technology as low or even degrading. Clear adaptation of motivation-enhancing prerequisites was indicated for a specific target group in order to support educational technologies.

Another dimension of motivation related to perceived value as influencing factor was clarified both for in-service and pre-service teachers. Many of them reported rather low recognition and perceived value of online education, and on the contrary, student teachers generally regarded online education-related topics such as pedagogy, techniques, methods, and tools more significant than face-to-face instruction. (Brändle et al., 2023) indicated that teachers' technology-related motivation also contributed positively to their work engagement and to their teaching innovation-related behaviour. However, for pre-service teachers, motivation toward technology integration had no significant medium effect on well-being. In addition, student teachers taking up online university studies due to a lack of alternative face-to-face conditions experienced occasional reduction or lapse, attributable to no costly equipment.

3.2. Anxiety, perceived threat, and digital fatigue

Digital technologies are widely used in education worldwide, but many teacher trainees are anxious about digital education. Anxiety is a concern because it can lead to students being less engaged, paying less attention, and achieving poorer learning outcomes (Cramer & Hosenfeld, 2023). Perceived threat is also relevant, as it can cause bad psychological states such as anxiety and boredom (Wang et al., 2023). The more a teacher trainee feels competence with digital tools, the lower the perceived threat and anxiety. Moreover, teacher trainees who frequently switch between learning or communication platforms, or between learning and non-learning applications, are more likely to experience digital fatigue. Digital fatigue is related to cognitive load and is a concern for user engagement.

3.3. Cognitive load management and mental workload awareness

Cognitive Load Theory (CLT) emphasizes knowledge acquisition and education research. It addresses the particulars of instruction and cognitive theory. Instruction interacts with cognitive architecture. A skilled performer bypasses elaborate knowledge and follows simplistic and flowing paths. Appropriately designed instruction promotes schema automation, leading to fluency. E-learning can assist schema acquisition. CLT helps designers establish precise and simplified interactions. Education is about knowledge acquisition. Education involves acquisition and construction. Education is

about growing capabilities and identities. Organizational learning is about collective construction. Instruction may influence the construction of history and identities. The instructed acquisition-construction discourse helps link knowledge and construction (Price, 2017).

Instructional design focuses on the properties and parameters of instruction. The CLT research program addresses crucial aspects of knowledge acquisition, complements and extends the discourse, and leads to the elaboration of instructional-design principles and guidelines. Nowadays, busy teachers receive professionally-designed instructional materials. Contextualized design often aligns more closely with teachers' current understanding of teaching and learning. E-learning design can provide teachers with the opportunity for remote and autonomous opportunities to rehearse instruction, practice and develop reflection and discourse. The ecology of context and the choice of design remain within the hands of designers and acquirers. CLT approaches such construction via acquisition. Human memory has limited capacity and time. If too many elements of separate information must be mentally integrated simultaneously, intrinsic cognitive load may exceed available cognitive capacity. Working memory is limited (D. Stiller & Bachmaier, 2018).

3.4. Metacognition and reflective practice in online learning

Online or distributed environments and learning management systems allow reflective practices to facilitate self-regulation. Metacognition encompasses knowledge about cognition and regulation of cognition; both are key to effective online learning. Online educators can support self-regulated learning through systems encouraging students to set goals, implement and monitor strategies, and evaluate effectiveness. Implementing suggestion prompts increases feedback use, enhances self-regulated learning, and fosters continuous improvement.

In reflections, students consider what and how they learn, how challenges are overcome, and formation or modification of knowledge and skills required to complete tasks. Reflecting on strategies and adjustments made offers justifications for their importance. Trainees provide examples of successful and unsuccessful approaches and analyze related thoughts, feelings, and ideas (Alden Rivers et al., 2014). The process highlights past experiences influencing decision-making and implications for teaching practice, advancing development of identity as future educators.

4. Measurement and assessment of preparedness

Teacher preparedness for digital education has attracted considerable attention from scholars; however, measurement of this construct remains underexplored. Methodological approaches range from quantitative scales, checklists, and surveys to qualitative instruments including interviews, focus groups, and reflective journals. Quantitative measures have been evaluated for validity and reliability and applied in specific contexts, whereas qualitative methods have been coded and triangulated according to established procedures. Interpretations of teacher preparedness vary according to culture, institutional context, education program, and subject area. Instruments that account for these factors will promote a more accurate understanding of the construct and its determinants (Molenje et al., 2017) ; (Brändle et al., 2023).

4.1. Instrumental approaches: scales and surveys

- Psychological Preparedness of Teacher Trainees for Digital Education
- Measurement and assessment of preparedness
- Instrumental approaches: scales and surveys

Conditions for successful digital education include a high level of psychological preparedness among teachers. Many developments have occurred in this field, leading to the emergence of a variety of digital competence frameworks and tools. A number of instruments have been developed to assess technological competence in teaching and learning or readiness for online and blended teaching and learning (Tzafilkou et al., 2022). The vast educational experience accumulated by study participants is taken into account during such assessments. The need to measure the psychological preparedness of teacher trainees for digital education has arisen based on the online delivery of courses and changes to pedagogy and assessment in higher education. Psychological preparedness encompasses motivation and attitudes toward technology integration, anxiety and perceived threat, cognitive load and mental work awareness, and metacognition and self-regulated learning. Extensive qualitative studies have investigated teacher psychological preparedness during the pandemic, but no systematic investigation has yet been undertaken with respect to teacher trainees. As a result, no instruments measuring the psychological preparedness of teacher trainees for digital education have been identified.

Across the globe, preparation for teaching is undertaken in formal education systems, but there is a lack of harmonization between preparation itself and educational reform (Llorente-Cejudo et al., 2022). There are variations not only in the assessment of teacher psychological preparedness for digital education, but also in its conceptualization at the levels of construct definition, dimension specification, and coverage of instrumental or survey tools. Instruments assessing the psychological preparedness of teacher trainees for digital education have thus been found to be either limited or entirely missing. Furthermore, teacher education has taken place in the context of a pandemic, and significant challenges have emerged that go beyond the preparation of teachers. The COVID-19 pandemic has imposed new norms on daily living, economic activity, and education. During the pandemic, face-to-face classes were suspended and many educational institutions shifted to online environments, either exclusively or in a blended mode. Teacher trainees preparing to be educators in higher education institutions across the globe are provided with an educational experience by educational institutions.

4.2. Qualitative insights: interviews and reflective journals

Teacher trainees at Teacher Training Schools (TTSs) in Valencia were interviewed, and 18 written reflections were collected in a Research Teacher Training (RTT) curriculum course. Both data sources were systematically analysed using a coding scheme developed from the dataset. Triangulation between the two data sources helped to clarify, complement, and cross-check the information (Quadros Flores et al., 2017).

First, 23 interviews were conducted in Spanish with 23 students (7 male, 16 female) from various TTSs. The Coding Alignment Scheme for the different data sources ensured that the same dimensions were assessed. Responses consistently pointed to digital pedagogy readiness being low; the long-term goal for the TTSs is to develop a training curriculum that provides added value.

Second, reflective journals were collected from 18 students enrolled in an RTT subject for future Primary Education teachers at a TTS. Journals are produced during Frame 0, before any training, introducing teacher trainees to the Learning Scenario (selection of the three on-line tools used in the subject). The Coding Alignment Scheme was shared to facilitate initial metacognitive reflection. Drafts of the journals, previously anonymised, were analysed. Journals provide information about self-efficacy (the students themselves recognise the need for training), the widespread presence of Google sites as a pedagogical tool, and the need for attention to Instructional Design. To maximise the dissemination of findings, other courses are also encouraged to incorporate reflective journals (Byrd, 2017).

4.3. Cross-cultural and programmatic considerations

Digital education is a widely discussed theme globally. Digital education as a general term refers to online education that distinguishes it from traditional face-to-face education. These differences may reason for the varying levels of psychological preparedness reported in teacher trainees from different countries. Prior studies have revealed that prospective teachers in certain countries have a low level of ICT-related knowledge and do not realize the importance of digital technology in teaching. Research conducted in Ghana has revealed an urgent need to train pre-service teachers on the use of digital technology to support their professional development.

A study aims to investigate cross-cultural and programmatic variation in psychological preparedness for teacher trainees of digital education is inevitable. (Brändle et al., 2023) explored an adjacent topic across different teacher education programs; the findings highlighted substantial differences between the self-assessed competence of student teachers from different subject clusters (STEM, Languages, Literature, Arts, and Social Sciences) regarding technology integration during instruction. Despite these differences in self-assessed knowledge, perceptions of both the importance of and personal motivation toward technology integration were found to be very similar for all clusters. Key insights from this study indicated an urgent need for teacher education institutions to provide learning opportunities that are adaptive to the subject cluster concerned to develop relevant competencies.

(Taner, 2018) investigated the acquisition of digital literacy during pre-service teacher education in Ghana. Across three teacher education colleges, the manner in which student teachers exploit the learning opportunities and experiences offered by the digital and ICT-related courses for their professional development was examined. The offering of these courses appears to provide these students with significant opportunities to learn and improve their digital skills and to acquire

knowledge about the relevance of utilising digital and ICT resources within pre-primary and primary teaching and learning processes. However, ICT provision remains limited and a number of barriers continue to hinder effective implementation of ICT within educational settings.

(Vostanis et al., 2022) demonstrated a large-scale digital child mental health training course targeting practitioners at the PhD, Master's, Degree and graduate levels across 20 sanctioned majority world countries, including Turkey and Pakistan. Evaluation, using pre-and post-course surveys, semi-structured interviews with course attendees and comments expressed via social media, indicated that the training was valued positively across diverse settings and professional groups. The study underlined the need for training of this nature, particularly within the context of reduced workforce capacity across the majority world and the complexity of the needs of service users.

The analysis shows that a cross-cultural and programmatic perspective may yield valuable additional insights into the psychological preparedness of teacher trainees for digital education. For a country like Ghana that has low levels of digital literacy, building awareness of the significance of technology in education could be vital for prospective teachers. The investigation could focus on whether such awareness is also considered important in countries with different educational provisions.

5. Influencing factors and determinants

The psychological readiness of pre-service teachers to engage in digital education has been examined from various angles and is influenced by multiple personal and situational factors.

First, prior experiences with information and communication technology (ICT) constitute a critical determinant of teachers' baseline readiness for integrating digital technologies into their practice. In many cases, previous exposure denotes an essential training need, although pedagogical experiences seem to have lesser impact on future ICT integration when teachers are already well-versed in the essential skills (Şahin & Levent Şahin, 2022). Second, teachers' pedagogical content knowledge specific to digital environments is intimately linked to their perceived preparedness and addressed topics in initial teacher education. Lessons adapted to the needs of diverse student audiences and digital assessment models are but a few areas where further pedagogical development is needed (Brändle et al., 2023). Supportive institutional frameworks for professional learning and access to mentoring and assistance initiate improvement in these areas and reinforce a culture of sharing resources across disciplines (Pozas & Letzel, 2023). Third, across all educational levels, teachers' integrated work-life balance and time-management skills strongly influence their overall wellbeing and risk of burnout—a consideration that determines long-term sustainability of professional practices.

5.1. Prior experience with information and communication technologies

The digital skills gap formed by the pandemic and the gradual integration of digital contents in educational programs expose the limitations of the digital readiness of individuals in academia or teacher training positions. Those who had prior experience with information and communication technologies tended to perform better than others in ICT-related tasks and developed a lower level of stress and anxiety when performing such tasks (Quadros Flores et al., 2017). International studies show that teacher trainees demonstrate low proficiency in digital competencies, with the greatest weaknesses in content creation and problem-solving skills. Moreover, significant gaps persist in the pedagogical knowledge and content understanding necessary for the effective integration of technology within teaching and learning processes. As a result, restructuring teacher training to enhance future educators' digital competence, while emphasizing pedagogical knowledge, is crucial (María Gómez Trigueros et al., 2019).

Student teachers often possess a low level of competence in the use of digital media and fail to recognize its added value. For the inclusion of digital media in teacher education to become widespread, training institutions need to consider appropriate, flexible, and usable training courses for all individuals regardless of their initial levels of competence. Therefore, a systematic approach to strengthening individual competencies is essential (Brändle et al., 2023).

5.2. Pedagogical content knowledge in digital environments

When using digital technologies for education, the discipline-specific skills and concepts relevant for pedagogical content knowledge (PCK)—that is, knowledge of how to teach subject matter—remain essential, though the nature of both subject matter and pedagogy alters (Gibson et al., 2011). Consequently, prospective teachers require opportunities to

engage with the revision and design of lesson content, learning activities, assessments, and technological applications through guided exploration of these subject-matter and technology interactions. Such teacher preparation aligns with TPACK (technological pedagogical content knowledge), which extends PCK by recognizing technology as a distinctive influence (María Gómez Trigueros et al., 2019). Instructor guidance in PCK and TPACK construction, particularly through scenarios responsive to the educational and technological contexts of prospective teachers' intended practice, supports both adaptability and continuity when acquiring competencies essential for digitally sustained education (Brändle et al., 2023).

5.3. Supportive institutional climates and mentoring

Institutional support for effective professional learning, mentoring, and conducive working environments influences the digital readiness of teacher trainees (Dinama et al., 2017). A supportive institutional climate emphasises collective professional development over individual advancement. Such a culture encourages teacher trainees to participate actively in learning opportunities, which are valuable for developing their digital competence. Institutional support can take many forms, such as in-service training and mentoring, which bolster access to time and well-designed learning experiences (Taner, 2018).

Career and development mentoring, beginning at pre-service training and continuing thereafter, strongly influences the psychological preparedness of teacher trainees and newly qualified teachers. Mentors with extensive experience and knowledge help guide new teachers through the early stages of their careers. In the highly demanding domain of digital education, mentors can help align responsible attitudes with broader goals, share strategies to avoid overload and sustain a safe learning environment, and promote positive coping mechanisms.

5.4. workload, time management, and wellbeing

The pandemic disrupted traditional educational delivery modes, including face-to-face classes, and forced educators to transition to digital or hybrid education systems with little or no training. These abrupt modifications in the delivery mode had an impact on teachers' psychological safety. The educator serves as a role model for students, and their psychological safety is crucial for the latter's mental, social, and emotional well-being. Online instruction demands fresh approaches to delivery and consideration of students' emotional and psychological requirements. Educators' technological readiness and related stays in a safe position influence the degree of structural transformation within a system. Teachers' prior and in-service training on adopting technology platforms and the resources available to them further affect their technological readiness. Awareness low or other psychological conditions brought on by the COVID-19 period affect teachers' emotional safety. Too many screentime hours also affect their health. Workload has emerged as a major source of stress during the pandemic (Yu et al., 2022). The resulting heightened level of stress has affected job performance, work-life balance, and emotional stability and has led some to consider leaving academia. Zoom fatigue is assumed as a main cause for mental exhaustion, among other personal work, health, and life engagements. In the educational context, the lack of psychological safety, poor wellbeing, and light controls cause participants to become less productive and engaged in remote learning. Stress affects how educators create student-centred environments in the digital sphere, on top of the widely perceived low professionalism associated with the set-up. Many educators avoid attempting various methods or platforms without the confident knowledge that comes from the necessary pre-requisite benchmarking (Stan, 2022).

6. Interventions and pedagogical strategies

Interventions favouring longer-term preparation for digital reading benefit motivation and self-perception in e-readiness and can support a positive identity transition from reader to digital reader, which may facilitate the disposal of printed books. For some students, e-reading remains a source of anxiety; therefore, professional digital reading experiences and courses enhancing competence, confidence, and e-reading habits are needed to increase the sharing of e-reading practices and the collective reading of digital texts (Quadros Flores et al., 2017). Professional development opportunities that extend over time offer educators the chance to engage in reflective practice and to receive feedback, coaching, and mentoring, all considered important for improving the quality of instruction and fostering change in practice; preliminary data on longitudinal, iterative opportunities indicate positive effects on teachers' persistence with improved practices and on instruction (D. Guillén-Gámez et al., 2022).

A pedagogical shift toward more student-centred or constructivist approaches using digital technologies provides opportunities for teachers to alter their practice; careful planning of early experiences helps in setting the stage for longer-term changes. A sequence of scaffolded digital opportunities in the area of modelling supports appropriate forms of change; the introduction of examples that are well aligned with the instructional focus enables a clear focus to be retained on modelling. Digital opportunities planned for before, during, and after the modelling task serve to reinforce the model explicitly; structured feedback on the first two modelling trials allows for anticipated instructional difficulties to be addressed. Aligning the assessment system with the emphasis on modelling further facilitates these opportunities by enabling instructors to provide congruent feedback to learners (Brändle et al., 2023).

6.1. Professional development that builds confidence and competence

To mitigate apprehension about technology integration, teacher training programs can emphasize the development of confidence alongside competence through the adoption of longitudinal, iterative professional development. Hine, Lam, and Cummings call attention to the need for both confidence and competence in pedagogical practices that uphold digital education; the former refers to teachers' belief that they can successfully incorporate technology in their teaching practices and the latter refers to practical strategies for implementation. Teacher education seldom affords opportunities for experimentation and active learning that develop pedagogical proficiency (Dai, 2023) ; consequently, confidence remains at a low baseline where a sufficient foundation has not yet been established.

Longitudinal, iterative professional development allows opportunities for teachers to rehearse and reflect on their digital instruction through progressively more sophisticated assignments. Because preliminary topics—such as student motivation, instructional design, and the learning process—affect interest in taking risks with technology (Quadros Flores et al., 2017) , training sessions should first focus on foundational pedagogical principles. Even at the initial stage, incorporating technology can help motivate teachers. Practice opportunities should build on successfully mastered capabilities, with feedback reinforcing correct execution and highlighting areas for enhancement.

6.2. Design of scaffolded digital teaching experiences

Digital teaching experiences should be designed to move teacher trainees progressively from simpler to more complex tasks in order to enhance their learning (Brändle et al., 2023). An initial stage involves requesting trainees to undertake a digital lesson plan formulation, followed by the preparation of a digital lesson that is executed either in real online classes or through video recordings. These first engagements focus on an understanding of the relevant content and subject-matter teaching expertise. The next phase elaborates on the specific pedagogical principles and frameworks that were employed during the design and implementation. The final stage ceaselessly dissects further scaffolding of the specific technological integration method that was adopted. By promoting such iterative and successive pedagogical-method discussions, the enhancement of trainees' pedagogical-content-focus during digital teaching experiences remains foregrounded (Quadros Flores et al., 2017). Each phase concentrates on a central aspect of pedagogy, therefore, the core element to impart, the subject-matter itself, remains retained and reinforces the content-knowledge teaching transfer to the trainee. Feedbacks from trainees indicates that such scaffolded professional exposure constitutes simulacra of a possible future workplace and is appreciably valued within the ongoing teacher-trainee-development continuum.

6.3. communities of practice and peer collaboration

Although student teachers involved in a teacher education program are often encouraged to share their learning experiences and challenges related to digital education technologies with their peers, they seldom engage with one another in professional conversations about these topics, even when they might feel the need to do so. Developing a collective engagement among student teachers in addressing these issues can potentially be a fruitful avenue for further exploration. Peer support features prominently in teacher training programs focused on information and communications technology (ICT) and pedagogy (Lee, 2018). Portrayed as a collaborative learning environment, the AduLeT community fosters self-development and improvement by promoting collaboration among peers (Gonçalves et al., 2019).

6.4. Psychological safety and inclusive online classrooms

In an increasingly digitalised world, psychological safety and inclusivity are evidently vital in all teaching practices. It is even more critical in teacher trainees, where an online classroom community is often formed when students have not met

face-to-face. Online classrooms should be inclusively designed to serve all students' psychological needs. In teacher education, such general rules are based on specific academic regulations for a Teaching and Learning Centre (TLC) with straightforward forms to be filled in that lead to a flexible balance between efficiency and freshness (Seetal et al., 2021).

Because online teaching platforms limit opportunities for visual communication, descriptive, precise, and simple words become significant. Mood and tone play a critical role in establishing safe online classrooms. To ensure systematical equitability with just administration nor the one-higher-level focus, guidelines, norms, and principles should be as clear, crisp, and abstract as possible.

7. Implications for teacher education programs and policy

A profound shift of instructional modalities has prompted educators to integrate digital tools into the teaching and learning process through blended learning, hybrid learning, and fully online models. Various forms of and digital technologies have been employed to support this shift, including instructional management systems, cloud applications, gaming, digital videos, and virtual learning platforms. Yet, the public indicates, based on numerous indicators of digital and media literacy, that the education system has fallen behind (E Cheek et al., 2019).

Consequently, teacher education programs are encouraged to examine and develop means to equip both preservice and in-service teachers with the skills needed to design, implement, and curate digitally supported instruction, regardless of the context and target audience. Technology-enhanced learning environments, which combine traditional face-to-face, mixed, or fully online education, pose additional instructional challenges to educators. Thus, extending teacher training programs and, more importantly, providing intentional faculty development opportunities that prepare educators to blend digital and face-to-face instruction to assure faculty digital readiness and comfort in doing so is vital.

7.1. Curriculum alignment with digital readiness goals

Coherent curriculum alignment with digital readiness goals ensures that competence development is explicitly integrated into teacher education programs (Brändle et al., 2023). Conceptually, digital readiness comprises a spectrum of cognition, motivation, and affective factors that signal preparedness to integrate digital technologies in teaching. Specific attention to pedagogical content knowledge, prior experience, and institutional support or readiness likewise remains essential.

Configurative guidelines delineate pedagogical training goals, proficiencies and competencies in teacher education, while orienting theoretical work—exemplifying social constructivism, digital readiness, or corresponding constructs—remain to be universally established or agreed upon.

7.2. Assessment reform and feedback mechanisms

Digital transformation in higher education was already progressing rapidly before the COVID-19 pandemic. COVID-19 merely accelerated these changes. Education institutions worldwide were compelled to shift operations, including teaching and learning processes, online. Pivotal to this transformation was the provision of online courses, especially at the programme level. Many institutions had already provided online courses but on limited scale, restricted largely to less critical learning, rehearsal or preparation, e-learning, or blended or hybrid education. Partly, teachers were encouraged or required to select courses that could benefit from being converted to an online format for that transformation. Nevertheless, because of the speed of this transformation, the demand for online course materials considerably exceeded the currently available supply In light of these developments, aligning teacher preparation programmes with the competencies necessary for a digital learning environment has become urgent for continued professional training. Preparedness encompasses both psychological elements, such as motivation and anxiety, and knowledge aspects, such as pedagogical content knowledge and technical skills. These elements can be measured categorically or instrumentally. A teacher-trainee study indicated that student teachers already possess varied levels of multiple literacy, and fulfilling further ICT competence frameworks could ensure compliance with specified demands. Conforming to the educational and operational challenges of Covid-19, assessment has also undergone reform, advocating additional input modes. Theoretically, blended, hybrid, and purely digital pedagogical practices exist, but the digital assessment in the study was never strictly defined. Digital pedagogical practices normally necessitate transforming curricula into smaller digestible units (Brändle et al., 2023) ; (O. Ade-Ojo & Sowe, 2011).

7.3. Longitudinal support and progression tracking

To develop psychological preparedness for digital education, teacher education programmes should incorporate a structured, longitudinal intervention framework. Such a framework would facilitate continuous engagement with relevant pedagogical practices while simultaneously gathering timely feedback to understand the status of preparedness and adapt support accordingly (Oberholzer & Oberholzer, 2017). Ideally, a broad range of classroom experiences would be provided, supporting exploration and experimentation with a variety of tools, methods, and strategies aligned with curriculum and assessment objectives (Brändle et al., 2023).

Teacher education programmes encompass cyclical phases of structured preparation, provision of classroom experience, and reflection on practices adopted. Initiatives may be mapped to early stages of this cycle, where a foundation is laid for significant ongoing development. Accordingly, effective summative assessments also act as formative evaluations, informing the design of subsequent preparation activities, suggested implementation practices, and broader programme revisions.

7.4. Equity considerations and accessibility

Digital education offers various opportunities for students, such as flexibility, accessibility, and self-directed learning. However, challenges arise as not all students have equal access to digital technology or infrastructure. Equity in digital education involves providing all learners with the necessary tools to effectively engage with and benefit from learning opportunities. Holistic solutions are required to eliminate barriers caused by technology gaps, social factors, and biases. It is essential to raise awareness among educators regarding the significance of appropriate tools and strategies for equitable digital education and accessibility to foster active student engagement (Peprah Opoku et al., 2023).

Teacher training presents an additional challenge since preservice special education teachers in the United Arab Emirates show limited intention to integrate assistive technology, which is vital for enabling students with disabilities to pursue learning objectives. Factors such as prior ICT experience, gender, and educational background influence their readiness to use such technology (Brändle et al., 2023). The effective implementation of digital education requires an equity-oriented perspective, leveraging tools and approaches grounded in sound pedagogical principles, regardless of the approach to digital learning (Montenegro Rueda & Fernández Cerero, 2019).

8. Methodological considerations for future research

Psychological readiness for online teaching—comprised of motivation, anxiety, mental load management, and metacognition—varies among beginning teachers. Study suggests pre-service teachers are encouraged to engage with digital tools during training to align their psychological state with objectives set in pedagogical curricula. Preparing future teachers to implement digital learning environments requires addressing multiple, interlinked components. Robust mixed-method designs could illuminate specific influences on psychological readiness in different contexts. Longitudinal designs would clarify the evolving nature of preparedness; cross-national studies would assess the extent to which observed profiles hold across diverse educational systems (Brändle et al., 2023).

9. Conclusion

Teacher educators must prepare future teachers to develop students' digital skills and digital readiness is key (Brändle et al., 2023). For teachers, digital preparations constitute a psychological mindset determining the use of digital technology during instruction. Teacher candidates' digital readiness is essential given that they constitute the majority of teachers in many settings. In this regard, teacher training programs should prepare future educators for digital education, especially in the current digital context. Despite its importance, no study has focused on measuring teacher candidates' psychological preparedness for digital education, particularly in the context of teacher education programs. Therefore, providing a reliable, valid, and practical instrument to assess teacher candidates' psychological readiness, considering psychological aspects of training remains a priority.

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