DIGITAL TECHNOLOGY-ENHANCED PEDAGOGY AND ITS INFLUENCE ON SUSTAINABLE PRE-SERVICE EDUCATORS' DEVELOPMENT IN ZIMBABWE

(Research Article)

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Abstract

In Zimbabwe, pre-service educators' professional development programme is evolving, and digital technologies play an essential part in this revolution. Henceforth, this article sought to unearth the influence of digital technology-enhanced pedagogy on sustainable pre-service educators' development. To accomplish this qualitative content review was conducted on 40 indexed (i.e., Elsevier, DOAJ and Google Scholar) published articles (2010 - 2024) focusing on the utilisation of digital technology-enhanced pedagogy in pre-service educators' development. This, qualitative content review was conducted to conceptualize digital technology-enhanced pedagogy in the context of sustainable pre-service educators' development in Zimbabwe; and identify the theories underpinning infusion of digital technology-enhanced pedagogy into pre-service educators' professional development. We showed how digital technology-enhanced pedagogy proffers opportunities in sustainable pre-service educators' development in Zimbabwe. Potential challenges encountered when integrating digital technology-enhanced pedagogy in sustainable pre-service educators' development in Zimbabwe were articulated. From the discussion, it can be concluded that the infusion of digital technology-enhanced pedagogy has positively influenced the sustainable development of pre-service educators. It is in this context that despite the challenges encountered when infusing digital technology-enhanced pedagogy into pre-service educators' development, we recommend that extra consideration be put in place in mobilizing relevant digital technology infrastructure and resources.

Keywords: Digital technology-enhanced pedagogy; sustainable; pre-service educators' development; Zimbabwe

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1. Introduction

Several massive changes that society has undergone, from the agrarian age to the industrial age, and now the information age have created a new global economy powered by technology, fueled by information and driven by knowledge (Nnaekwe & Ugwu, 2019). In the recent times, phenomenal growth in digital technologies has been witnesses the world over (Sigauke, 2017). This has created some serious implications for the nature and purpose of higher education in line with the demands of the 'Education 5.0' doctrine (Muzira & Bondai, 2020). Thus, the Government of Zimbabwe has facilitated the acquisition of digital technologies, with the view to integrate them in teaching and learning activities. This drastic transformation has certainly affected education system at its various levels (i.e., basic education, higher education) (Chimbi & Jita, 2019).
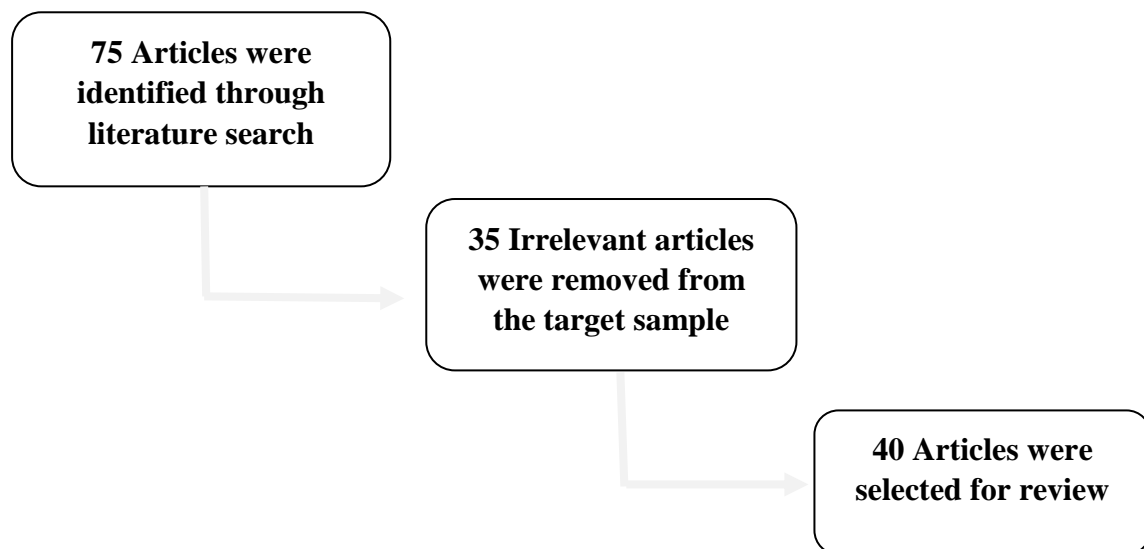
Hence, the infusion of these digital technologies offers unprecedented opportunities to the education system (Ministry of Higher and Tertiary Education, Science and Technology Development, 2018). In this context, infusion of digital technology-enhanced pedagogy into pre-service educators' development programmes is considered a critical issue, since it can facilitate in equipping educators with relevant competencies (Ramaila & Mavuru, 2023). In this regard, digital technologies are increasingly becoming influential, and are seen as a gateway for the raising of educational standards in developing countries (Daniela, 2019). Therefore, digital technology-enhanced pedagogy brings about a paradigm shift in the process of learning from lecturer-centeredness to pre-service educator-centeredness whereby the lecturers pass the information more quickly and in a more understandable manner (Ma, et al., 2008).

It is an unquestionable fact that sustainable teaching and learning in pre-service educators' development is dependent on the use of participatory methods and problem-solving approaches for both theoretical and practical activities (Gondo et al., 2019). Yet, Dondofema and Shumba (2018); Michel and Pierrot (2022); Sunzuma and Maharaj (2022), argue that most practicing educators in developing countries (i.e., Zimbabwe) choose not to infuse digital technology-enhanced pedagogy in teaching and learning activities, because these did not form part of their pre-service educator development programme. As a result of this, pre-service educators might not realize the relevance of digital technology-enhanced pedagogy to teaching and learning activities at various levels of education. This is an indication that pre-service educators to a certain extent are experiencing inadequate prospects to systematic digital technology-enhanced development ingenuities (Noyi, 2013). This has prompted the need for and provides an opportunity to look at the art of teaching and learning in pre-service educator's development (Naweseb, 2012). However, it is also imperative to note that despite the affluence of these digital technologies, their effective integration into pre-service

educators' formation programmes in Zimbabwe was a cause for` concern. It is the impetus of this paper to establish the influence of digital technology-enhanced pedagogy on sustainable pre-service educators' development.

2. Method

In this study, a qualitative content review search approach was used to locate relevant scientific literature concerning digital technology-enhanced teaching and learning in pre-service educators' development in Zimbabwe. The review focused on key bibliographic databases including: Elsevier, DOAJ and Google Scholar. Specifically, the search targeted words like 'digital*' OR 'technology*' OR 'ICT*' AND 'pedagogy*' OR 'teaching*' OR 'learning*' OR 'pre-service*' OR 'teacher education*' that were used in the title, abstract, keywords and references. A two-tier screening approach was then used to assess the appropriateness of the studies retrieved by the search strategy. First, titles, abstracts, and keywords of articles available in English in the period 2000 – 2024, totaling 75 were reviewed. The retrieved publications were then further examined to select those focusing on the core subject matter and 35 were removed due to irrelevance in terms of the earlier on articulated inclusion criteria. Hence, 40 articles were selected to be discussed in details in relation to the issue under investigation. The articles selection procedure is presented in Figure 1 below.

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Figure 1: Article Selection Procedure

3. Findings

This section interrogates the infusion of digital technology-enhanced pedagogy into pre-service educators' development for sustainable development in Zimbabwe guided by the following themes:

3.1 Conceptualizing digital technology-enhanced pedagogy

In the past few years, digital technology-enhanced pedagogy has gained popularity as more educational institutions adopted them to support teaching and learning activities in higher education (Morel & Spector, 2022). Thus, digital technologies behave as a platform to distribute and oversee pedagogical material (Watson, 2012). In this context, digital technology-enhanced pedagogy functions include promoting specially designed information for capturing pre-service educators' progress in meeting expectations (Oakes, 2002). Therefore, digital technology-enhanced pedagogy for the purpose of this discussion is considered as the platform that nurtures an environment for the pre-service educators' engagement in development related activities (Yang & Hong, 2024).

In this context, digital technology-enhanced pedagogy denotes a scenario where pre-service educators in Zimbabwe are exposed to digital technologies and technological solutions that support their engagement in capacity development. This incorporates numerous emerging and streamline digital technologies such as Learning Management Systems, Mobile Learning applications, Virtual and Augmented Reality interventions, and cloud learning services. In addition, it comprises a wide variety of practices underpinned by principles acquired through training and as a result of experiences and personal understandings (Moyles et al., 2002). Thus, digital technology-enhanced pedagogy has the potential to make teaching and learning in pre-service educators' development more interactive and collaborative through the existing e-learning management systems (Alecu, 2023).

Therefore, this creates an easy and flexible pathway through which pre-service educators in Zimbabwe can access course materials and complete assignments. In addition, that there is a positive correlation between pre-service educators' commitment to using digital technology-enhanced pedagogy in teaching and learning activities (Mödritscher et al., 2013). In this case, pre-service educators in Zimbabwe have access to a variety of multi-media resources through digital technology systems (i.e., video, podcasts, and interactive simulations) and these can enhance their motivation and engagement in teaching and learning activities (Bolliger & Martin, 2018). Therefore, pre-service educators in Zimbabwe find it appealing since digital technology-enhanced pedagogy exposes them to resources around-the-clock and accords them the opportunity to work on assigned activities at their own pace (Hartnett et al., 2011).

In addition, digital technology-enhanced pedagogy provides a structure for synchronous teaching and learning approach as pre-service educators in Zimbabwe can interact with their lecturers through videos, online discussions, live chats, presentations and access to word files (Alzahrani, 2019). Notwithstanding the notion that digital technology-enhanced pedagogy exposes pre-service educators in Zimbabwe to asynchronous teaching and learning delivery methods. This allows lecturers and students to interact with resource materials and with each other without necessary being in the same physical location, time, or according to lecturers and pre-service science educators' insights (Petrenko, 2024). In this context, digital technology-enhanced pedagogy provides a structure for asynchronous teaching and learning activity delivery method (i.e., emails, group discussions, audio presentations, and newspapers), so as to cultivate a mindset of positive interaction amongst the pre-service educators in Zimbabwe for sustainable development (Wang & Li, 2011).

This allows for the pre-service educators to interact with each other without the distraction of being separated through distance and time. In the same vein, this approach helps pre-service educators with conflicting commitments (i.e., work or family obligations), as it allows them to access the resource materials and to interact with their colleagues, whenever it's convenient to them (Gunawardena et al., 2001). It's critical to acknowledge that in Zimbabwe both the lecturers and pre-service educators' adaptation to digital technology-enhanced pedagogy help in efficiently their time amongst the competing obligations. However, this approach has the potential in facilitating delay in the provision of feedback and decreased pre-service educators' participation in the interactions (Means et al., 2010).

3.2. Theoretical framework underpinning integration of digital technology-enhanced pedagogy into sustainable pre-service educators' development

Digital technology over the years has been acknowledged to have either a direct or indirect influence on pre-service educators' development (Marshall et al., 2024). It is in this regard this discussion was ground in the Technological-Pedagogical-Content-Knowledge (TPACK) framework (Koehler & Mishra, 2009). This centres on how to work with information technology (technological knowledge), ways of facilitating learning (pedagogical knowledge) and the subject matter to be learned (content knowledge) (Gumiero & Pazuch, 2024). Thus, this combines the technological knowledge pedagogical knowledge resulting in the establishment of a relationship between technology and learning (all of which constitute technological pedagogical knowledge) (Arifin et al., 2020). Therefore, this creates the need to conceptualise how technology can enhance the teaching and learning of specific content areas (Gulzoda, 2024), in pre-service educators' development programmes.

In addition, constructivist learning theories (i.e., social constructivism and cognitive constructivism) provide an underpinning for conceptualizing how pre-service educators construct knowledge and engage actively with their environment with the aid of digital technologies. In this context, digital technologies as tools for active exploration can leverage the sustainable pre-service educators' development programmes (Boldaji, 2024). This is so since it gives emphasis to student-centered and inquiry-based instruction. To cement the significance of the crafted framework, connectivism theory was included the discussion, since it's articulated as the possible successor to the behaviourism, cognitivism and constructivism theories in this digital era (Naidoo & Mabaso, 2023).

TPACK in pre-service educators' development can be used as a guiding framework for the infusing a diagnostic lens in teaching and learning activities (Mishra & Koehler, 2006). Thus, this framework highlights that control does not entirely rest on the lecturers, instead it gives more autonomy to pre-service educators over their teaching and learning activities (Donnelly, 2013). This articulates the position of digital-enhanced technology in facilitating the internet-worked collaborations and information exchange between the lecturers and pre-service educators (Pedemonte et al., 2023), in Zimbabwe. Therefore, these theoretical foundations ground the methodology for developing pre-service educators' pedagogical competence in digital technologies. In this regard, pre-service educators can gain a solid conceptualisation of the philosophies, concepts, and methods essential for effective facilitating teaching and learning activities.

3.3. Opportunities associated with integrating digital technology-enhanced pedagogy into sustainable educators' development

This section sought to gain insight into the opportunities associated with integrating digital technology-enhanced pedagogy into pre-service educators' development programmes in Zimbabwe. According to Ludlow and Duff (2009), digital technology-enhanced pedagogy has had a more dramatic influence on teaching and learning activities in pre-service educators' development programmes. Thus, it offers immeasurable opportunities to learn, to teach more effectively and to contribute to the process of knowledge construction (Daniela et al., 2018). The digital technology-enhanced pedagogy has the capacity to support pre-service educators in Zimbabwe in knowledge-building process, thereby enabling them to acquire critical thinking skills (Bereiter & Scardamalia, 2018). Thus, it can used in facilitating pre-service educators' higher order thinking taking into cognisance the development of the cognitive process (Tlhoaele et al., 2016). In this case, pre-service educators develop predictive analytical competence that enables them to gauge the potential outcomes of the use of these in learning activities (Lee & Choi, 2015). In other words, other words the integration of digital technology-enhanced pedagogy tends to motivate pre-service educators in Zimbabwe to participate actively in the teaching and learning activities.

The infusion of digital technology-enhanced pedagogy into pre-service educators' development underscores the need for pro-active understandings, and workshops to boost their skills in the utilisation of ICT resources in teaching and learning activities. For instance, digital technology-enhanced pedagogy, allows pre-service educators in Zimbabwe access to web-based applications (i.e., Web 2.0) that involve voice, video, social networking, content sharing to facilitate communication and collaboration (Lorenzetti, 2009). In addition, this enables pre-service science educators in Zimbabwe to reach new levels of connectedness to their lecturers, and peers during a time that is incredibly demanding (Caraher & Braselman, 2010). So, this provides the lecturer-pre-service educator or pre-service educator - pre-service educator in Zimbabwe with the real time and time-delayed collaboration. In this case, as the users are in position to determine the direction and content of these applications (Roblyer & Edwards, 2010). Accordingly, the digital technology-enhanced pedagogy has shifted the role of lecturers from deliverers of instruction to that of facilitators of teaching and learning and have made pre-service educators in Zimbabwe the centre of attention (Gunga & Ricketts, 2008). In this case, the digital technology-enhanced pedagogy nurtures collaboration and critical thinking skills among pre-service educators as they traverse the digital teaching and learning experiences. Consequently, through the digital technology-enhanced pedagogy, pre-service educators are engaged in reflective practice that boosts self-reflection, peer feedback, and the utilization of assessment tools to monitor their learning.

In this context, teaching and learning becomes centred on pre-service educator rather than lecturer (Yanti et al., 2024). However, the successful infusion of digital technology-enhanced pedagogy in sustainable pre-service educators' development in Zimbabwe requires effective uses of learning theories and content-specific approaches guided by the goals of education. This call for the consideration of instructional strategies that recognises their prior experiences and knowledge, interest, and learning styles (Ranasinghe & Leisher, 2009). This is so since teaching with technology is not a one-size-fits-all approach as it depends on the types of technology in use at the time and also the content being taught (Orlando & Attard, 2015). This offers the institution an opportunity to transform the teaching and learning environment helping pre-service science educators in Zimbabwe to meet standards. Subsequently, digital technology-enhanced pedagogy has become a focal point in professional development, with a deliberate emphasis on integrating digital tools and online platforms to enhance the pre-service educators' exposure to relevant teaching and learning experiences (Hayati & Zaim, 2024). There, through the digital technology, pre-service educators acquire a comprehensive understanding of practical skills, and operative pedagogical approaches, which augment their pedagogical competence in producing eloquent teaching and learning experiences for the students.

4.4 Challenges faced when integrating digital technology-enhanced pedagogy into sustainable pre-service educators' development

While higher education endeavors to provide equitable teaching and learning experiences to pre-service educators in Zimbabwe for their sustainable development through digital technology-enhanced pedagogy, the realization of this pedagogical goal may be hindered by the following challenges:

4.4.1   Limited ICT supported infrastructure and resources

The effective integration of digital technology-enhanced pedagogy into sustainable pre-service educators' development needs appropriate infrastructure and resources (Khan et al., 2012). However, in Zimbabwe the integration of these is hampered by scarcity of ICT supported infrastructure and resources (i.e., computers, printers, multimedia projectors, scanners, and smartphones). In addition, the use of digital technology-enhanced pedagogy is affected by the unreliable electricity supply in most parts of the country. The development of digital technology-enhanced pedagogy infrastructure in a country is dependent on the availability of a reliable electricity supply. In some instances, some institutions experiences shortages of up-to-date hardware and software, and high-speed internet connection, which are key features in the diffusion of technology (Gulbahar, 2007).

4.4.2 Limited digital technology-enhanced pedagogy knowledge and skills

The effective infusion of digital technology-enhanced pedagogy into sustainable pre-service educators' development largely depends on the lecturers' ICT and pedagogical knowledge and skills (Pelgrum, 2001). Thus, the lecturers' limited knowledge and skills on how to blend ICT and pedagogy is considered as one of the main hindrances to the use of digital technology in pre-service educators learning activities (Ihmeideh, 2009; Mamun, & Tapan, 2009).

5. **Discussion**

The technological advancement continues to redefine how lecturers and pre-service educators interact in their teaching and learning activities. This context the concept of digital technology-enhanced pedagogy emerged as a cornerstone in preparing future educators to excel in future classrooms. Hence, the infusion of digital technology-enhanced pedagogy into pre-service educators' development programmes represented a paradigm shift towards knowledge base that fosters student-centered pedagogy, prioritizing critical thinking, and collaboration. This plays a significant role in equipping pre-service educators with the relevant knowledge, skills and values needed in embracing and effectively implement the new pedagogical thrust grounded in technology-enhanced teaching and learning tools. In this way pre-service educators are empowered to thrive in diverse and ever-changing educational

environments. Despite the existence of opportunities concerning the infusion of digital technology-enhanced pedagogy, there remain challenges in ensuring its effective implementation within the pre-service educators' development programmes in Zimbabwe.

6. Conclusions

From the above discussion it can be acknowledged that the infusion of digital technology-enhanced pedagogy into sustainable pre-service educators' development has various opportunities (i.e., promotes lecturer-student or student-student interaction). This advances the shift from the traditional lecturer-centred to student-centred approach to learning activities during pre-service educators' development. However, some challenges are encountered as the digital technology-enhanced pedagogy is infuse into pre-service educators' sustainable development. In this regard, it can be concluded that in spite of the existence of some challenges, digital technology-enhanced pedagogy has positively influenced on pre-service educators' development programmes as it better prepares them to navigate and infuse technologies into teaching and learning activities. Thus, the infusion of digital technology-enhanced pedagogy into pre-service educators' development programme can facilitate in the production of new generation of educators who are responsive, and adaptable to the requirements of teaching and learning activities in the digital era. From this discussion it recommended that the infusion of digital technology-enhanced pedagogy into pre-service educators' development should be grounded in the mobilization and availability of adequate ICT infrastructure and resources.

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