**Exploring the Digital Literacy of Digital Natives: A Pilot Study of Preservice Teachers**

**Abstract**

The decline in pedagogical technology training in teacher education programs is at least partly attributable to the idea that current students are “digital natives’, fluent in the use of technology because they have grown up in a global environment infused with it. However, little research has been done on preservice teachers to determine the validity of this paradigm. Clarifying the veracity of the idea of “digital natives” and digital literacy of teacher trainees is critically important as deficiencies in both/either undermine the education of future generations of schoolchildren. This pilot project involving 44 students in a teacher education program in the USA was designed to determine whether broader investigation into the digital literacy of preservice teachers was warranted. A survey examining nine different areas of digital literacy was used to assess participants’ perceptions of their abilities and experiences with technology. Descriptive date (means; frequencies) were used to characterize differences across the sample. Results found notable heterogeneity across multiple dimensions of digital literacy, indicating the concept of digital native may be problematic. This indicates the need for a larger follow-up study to confirm these initial findings and identify potential remedies for digital literacy deficiencies in preservice teachers.

**Keywords:** Digital Literacy, Digital Natives, pedagogical technology training, teacher education programs

**Introduction**

For years, teachers’ technology skills were considered the barrier for technology integration in the curriculum. This obstacle was believed to be removed when a new generation of students, labeled as digital natives, began entering the teaching profession. Prensky (2001a) introduced the term “digital natives” to characterize the young generation who were born after 1980 and grew up, surrounded by technologies: computers, iPads, cell phones, video games, internet, and social media. Other terms emerged later such as net generation, digital generation, and millennials and are interchangeable with digital natives. Roberts (2005) described the generation of digital natives: “Net Generation students have never known a world without computers, the World Wide Web, highly interactive video games, and cellular phones” (p. 5.3).

**Literature Review**

Raised in the digital age, digital natives are naturally comfortable with technologies and are technologically savvy, which distinguished them from previous generations labeled as digital immigrants, another term coined by Prensky (2001a). According to Prensky (2001b), the divide between generations is based on familiarity with digital technologies. Digital immigrants, born before the digital age, had to adapt to the digital world as if learning a new language, whereas digital natives are “native speakers” of the digital language of computers, video games and the Internet” (2001a & 2001b). Notably, digital immigrants tend to retain their accents –certain pre-digital habits. For example, digital immigrants generally prefer print manuals and edit on paper rather than on screens (American Library Association, 2015). On the contrary, digital natives have seamlessly woven technology into their daily lives.

Prensky’s claims about digital natives garnered huge media coverage and resonated across various aspects of society. Digital natives were hailed as inherently tech-savvy and innately digital literate ([Puybaraud](https://www.workdesign.com/author/marie-puybaraud/), 2012). Enthralled by the concept, people spoke of digital natives with praise, admiration, and awe. Digital natives had distinguished characteristics: They were multitaskers, Internet surfers, always-on communicators, multimedia designers/users, and 3D online video gamers (Bennett et al., 2008; Kirschner & De Bruyckere, 2017; Roberts, 2005; Oblinger & Oblinger, 2005; Prensky, 2001). Digital natives were assumed to intuitively grasping modern technologies and adapt effortlessly to the evolving digital world. Windham (2005) described her daily experience as a digital native: “With information and accessibility lying effortless at my fingertips, I have grown accustomed to juggling multiple tasks at once, at lightning speed. In the average online conversation with a friend, for instance, I am likely to be talking to two others, shopping online at Barnes & Noble, laughing out loud at Friends reruns, and printing off notes from a chemistry lecture. It is only in the classroom, therefore, that my mind is trained on one subject” (p. 5.7).

Advocates called for curriculum reforms to accommodate the digital generation who learn and think differently (Autry & Berge, 2011; Dede, 2005; Oblinger & Oblinger, 2005; Kelly et al., 2009; Tapscott, 2009) as Prensky (2001b) asserted “…today’s students think and process information fundamentally differently from their predecessors. These differences go far further and deeper than most educators suspect or realize” (p. 1). Institutions should engage digital natives in dialogue with digital natives and leverage their experiences and insights for effective technology integration (Roberts, 2005).

The world was captivated by the new concept of digital natives. It was not until 2008 that questions were raised about the validity of the concept. Bennett et al. (2008) published " The ‘digital natives’ debate: A critical review of the evidence", arguing that there was no substantial empirical evidence to support the claim that the entire young generation possessed advanced digital skills because **young people’s digital skills varied significantly**. Some young people were highly proficient with technology while a large proportion of young people did not have the levels of technology skills assumed by advocates of the digital native concept.

Other scholars subsequently echoed these concerns, challenging the assumption that digital natives were innate digital literate and highlighting the lack of research evidence to support the claim (Bullen et al. 2009; Creighton, 2018; Gros et al., 2012; Judd, 2018; Margaryan & Littlejohn, 2008). In their systematic review, **Bennett et al. (2008) cautioned against educational reforms based on this notion: “**We shall argue that though such calls for major change in education are being widely propounded, they have been subjected to little critical scrutiny, are under-theorised [sic] and lack a sound empirical basis. There is thus a pressing need for theoretically informed research” (p. 776).

Despite these critiques, teacher education embraced the digital native rhetoric without skepticism. Many assumed that preservice teachers, as digital natives, would possess advanced technology skills compared to their professors. As the result, teacher education programs revised curricula to align with presumed digital proficiency, removing the required technology courses against the cautions that such revisions might not be warranted (Bullen, 2009; Bennett et al., 2008; Kennedy et al. 2008).

 Digital generation is an over-generalized assertion: “…it is not obvious that such a digital generation actually exists in a homogenous way” (Gros et al., 2012, p. 191). The young generation, as a whole, do not fit the profile of digital natives (Guo, Dobson & Petrina, 2008; Kennedy et al., 2008; Margaryan & Littlejohn, 2008; Smith, Kahlke & Judd, 2020; Wallace-Spurgin, 2020). Research showed that there were considerable variation in young people’s technology skills. While some students demonstrate sophisticated digital competences, many do not have the level of digital proficiencies featured in the profile of digital natives (Margaryan & Littlejohn (2008). Studies reveal that students primarily used a limited range of technologies, had a low level of familiarity with creation tools, virtual worlds, web publishing, and other emergent social technologies” and did not demonstrate that they learned differently from previous generations. As a consequence, “the digital native stereotype does not accurately reflect the way that younger people – including many learners and practitioners – perceive, use, or interact with or through technology” (Smith, Kahlke & Judd, 2020, p. 10). Many university students were not comfortable with emerging technologies. In a calculus class, students struggled with the software supposed to assist them in learning and complained that the software was too difficult to master (Karjanto, 2021). In applying technologies, most digital natives function as consumers rather than producers. They may skillfully navigate the internet and access multimedia content but often lack experience in creating digital materials (Bennett et al., 2008). Wallace-Spurgin (2020) found that students spent the majority of time surfing the net rather than engaging in media/content production: “In addition, it was found that students use technology for information searches the majority of the time rather than media development or to collaborate among peers for example, which is associated with higher-levels of cognitive engagement” (p. 24). These findings challenge the assumption that university students, as digital natives, inherently possess advanced digital literacy.

Research involving preservice teachers has shown a similar pattern. Bai (2019) suggests that preservice teachers may not be as technology savvy as widely assumed, with reports they rank their technology skills as low (Kara, 2021), often lack confidence in using educational software (Jeffrey, 2019) or hold negative attitudes about online learning (Lukina et al. 2022). Hlas, Conroy & Hildebrandt (2017) found almost 90% of student teachers in their study rated their technology competencies as novice or intermediate, even after completing all of the courses in their teacher education programs. Dincer (2018) attributed the low digital proficiency of preservice teaches to the inadequate technology training following the removal of technology courses from teacher education programs.

Preservice teachers’ technology proficiency is an essential component in integrating technology in the curriculum. The TPACK model, a widely applied framework for effective technology integration in educational contexts, contains three essential components: technological knowledge (TK); pedagogical knowledge (PK); content knowledge (CK). The three components are building blocks, scaffolding each other in the process for technology integration. Preservice teachers’ digital proficiency is the prerequisite for students to develop teaching strategies while learning subject knowledge as they move along the teacher education program. Nevertheless, the myth of digital natives as innate digital literacy had rendered the component technical knowledge as insignificant, thus removing the important foundation for successful technology integration into their teaching practices.

Given the lack of research supporting the digital native concept, teacher education must acknowledge the reality that digital literacy requires systematic training to develop. Curriculum design and instructional strategies should be informed by empirical evidence. Therefore, it is imperative to investigate preservice teacher perceptions and actual digital competencies for developing targeted interventions to enhance their ability to integrate technology effectively in future classrooms. However, due to the widespread acceptance of the digital native paradigm, research on preservice teacher digital literacy has been limited. Of the few studies published to date, none have generated a comprehensive profile of preservice teacher perceptions of and/or actual technological competency.

Therefore, the purpose of this study was to explore preservice teacher perceptions of their digital literacy across multiple digital dimensions, including: (a) information access and sharing; (b) communication; (c) content creation; (d) data storage and organization; (e) collaboration; and (f) proficiency with commonly used software, to determine whether there was sufficient divergence from the “digital native” model to warrant a larger study, the ultimate aim of which would be to identify specific deficiencies in teacher trainee digital literacy and to recommend “best practice” options to rectify them.

**Methodology**

**Sampling of the Study**

This pilot project involved 44 undergraduate students in introductory teacher education courses during the 2024-2025 academic year at a large urban university in the southeast of the United States of America.

**Study Protocol:**

To explore multiple dimensions of digital literacy in this cohort of teacher trainees an initial questionnaire was designed based on a review of previous research and the refined by a panel of subject-matter experts. For Tables 1, 2, 4-7, a 10-point Likert scale was used (1: not at all proficient; 2-3: slightly proficient; 4-5: somewhat proficient; 6: moderately proficient; 7-8: proficient; 9: very proficient; 10: extremely proficient).

Descriptive data (frequencies and means) were analyzed.

**Results:**

Pre-service teachers, in general, report a **high level of proficiency** in accessing, searching, and organizing online information (Table 1). The highest-rated proficiency includes the ability to **locate needed information (M = 8.82)**, **use various search engines (M = 8.7)**, and **identify appropriate keywords (M = 8.73)**, **organize downloaded content (M = 8.39)** and **using Google Scholar to find academic sources (M = 8.2)**. All the skills are essential in academic research and digital navigation.

However, proficiency levels begin to drop when it comes to **media-related tasks such as downloading music (M=7.5) and videos (M=7.7).** Participants only report moderate proficiency in **uploading music (M = 6.5).**

Pre-service teachers demonstrate a very high level of proficiency in using a wide range of digital communication tools (Table 2). The highest-rated proficiency includes email (M = 9.23), Snapchat (M = 9.23), and FaceTime (M = 9.05), which reflect students’ strong familiarity with both traditional and mobile-based communication tools. Participants also reported high proficiency in using video conferencing tools such as Zoom, Google Meet, and Skype (M = 9.16).

Participants reported moderate proficiency in Zoom presentations (M = 7.68) and WhatsApp (M = 7.02). Fairly good level of proficiency was reported in Twitter, including tweeting (M = 8.18) and using hashtags (M = 8.5), instant messaging apps (M = 8.36), Instagram (M = 8.7), and blogging (M = 8.77).

Participants reported uneven **proficiency in creating multimedia digital content (Table 3)**. They had strong experiences in creating common forms of multimedia content, particularly those that are widely used in both educational and personal contexts. Nearly all participants reported having created **PowerPoint presentations (97.73%)**, and a large majority have **edited photos (88.64%)**, **created videos (84.09%)**, and **created Facebook pages (84.09%)**. Additionally, a substantial number have **edited videos (79.55%)** and **posted videos on YouTube (56.82%)**.

However, students’ experience drops significantly with more specialized or less commonly used tools. Only **25%** of respondents had experience **creating a podcast**, **designing a newsletter**, or **publishing a webpage**, and even fewer reported **creating a blog (18.18%)**. Notably, **none of the participants (0%)** had created a Wiki page, and only **9.09%** had ever contributed to Wikipedia.

Participants reported, in general, **high proficiency** in storing and organizing digital content (Table 4). The strongest reported skills include the ability to **create and share files on Google Docs (M = 8.75)**, and **store/share content using Google Drive (M = 8.43)**.

Participants also demonstrated good proficiency in **converting file formats** across different formats) **(M = 8.27).**  Skills in **Microsoft OneDrive (M = 7.8)** and **online drives generally (M = 8.02)** were also relatively strong, although not as highly rated as Google-based tools.

In contrast, moderate proficiency levels are reported for tools like **Dropbox (M = 6.36)**, indicating that this platform was either less familiar or less frequently used by the participants.

These results suggest that while preservice teachers are generally confident in using cloud-based tools for storage and collaboration, their proficiency varies depending on the specific platform.

Participants rate themselves as proficient in using Zoom (M = 8.55), general online tools or software (M = 8.27), discussion boards (M = 8.20), and Microsoft Teams (M = 7.02). For less formal or emerging platforms, the reported proficiency levels are lower. Participants rate themselves as moderately proficientin using Facebook groups (M = 6.82), online gaming (M = 6.57), and virtual reality environments (M = 6.86). The high standard deviations for these items suggest substantial variability in individual experience and comfort levels.

The results show that while preservice teachers are confident and proficient in mainstream online platforms, their proficiency with social, gaming, and immersive technologies is more variable and generally at a moderate level.

Pre-service teachers reported good proficiency in using various PowerPoint features (Table 5). The highest-rated skill was designing a background (M = 8.57), followed by inserting videos (M = 8.23) and editing photos (M = 7.86).

Participants also demonstrated proficiency in using features like advancing slides automatically (M = 7.61) and inserting web links (M = 8.05). Slightly lower but still proficient skills were reported in recording voice (M = 7.43) and creating animations (M = 7.00).

Notably, the lowest proficiency was reported in applying SmartArt (M = 5.14), suggesting that students had limited familiarity with this feature. Meanwhile, inserting music (M = 6.59) and embedding Word or Excel files (M = 6.91) also received lower mean scores.

Pre-service teachers have proficiency in using some standard Word features, but limited experience with more advanced functions (Table 6). The highest-rated skills include inserting headings (M = 7.59), adding a table (M = 7.18), and inserting footnotes and endnotes (M = 6.89).

In contrast, lower proficiency levels were reported for more complex or specialized features such as applying track changes (M = 3.16), customizing ribbons (M = 3.39), and performing a mail merge (M = 3.5).

Skills such as using pre-designed styles (M = 6.27), creating diagrams (M = 5.68), and modifying the quick access toolbar (M = 5.00) fall into a moderate or less moderate range.

Pre-service teachers were less proficient in using Excel features (Table 7). The highest-rated skill was entering data (M = 7.09). Less than moderate proficiency was reported in areas such as performing calculations (M = 5.55), sorting data (M = 5.39), and generating charts and graphs (M = 5.36).

However, lower proficiency scores were observed for more advanced features such as using built-in formulas (M = 4.91), using conditional formatting (M = 4.25), and conducting what-if analysis (M = 3.89). These findings show that while students may use Excel for basic tasks, they are less proficient in applying analytical tools.

Pre-service teachers, in general, hold positive beliefs about digital technologies and demonstrate a moderate to high level of awareness and understanding in key areas of digital literacy (Table 8).

A majority agreed or strongly agreed that they are proficient in using digital technologies to solve problems and achieve their goals (M = 4.09) and consider themselves digital natives (M = 3.8). There was a strong consensus on the dual impact of technology on society, with 90.9% of respondents acknowledging both positive and negative effects (M = 4.45). Respondents showed good understanding of information credibility, with most reporting they had abilities to assess the quality and reliability of information (M = 4.11) and regularly evaluate credibility of information before using it (M = 3.84). Knowledge of copyright and fair use policies was moderate, with means of 3.95 and 3.84 respectively. Views were more divided on the idea that there are no limits to using online materials for education, with a lower mean score (M = 3.64). Awareness of broader issues like the digital divide (M = 3.93) and online safety (M = 4.2) was relatively high.

Finally, participants recognized that limiting digital technology to personal use restricts its potential (M = 3.57), and most agreed that technology should be integrated into university teaching (M = 4.0).

**Discussion**

This exploratory investigation examined digital literacy of pre-service teachers across a range of competencies, from information access and content creation to digital communication and beliefs about technology use. The findings offer a snapshot of their current proficiencies in digital literacy, potential concerns, and areas for improvement.

Pre-service teachers in this study reported high levels of proficiency in digital literacy related to information access, organization, and communication. To be more specific, students had strongest competencies in: (a) locating and managing online information (Table 1), (b) using email and social media platforms for communication (Table 2), and (c) collaborating through tools like Google Docs and Zoom (Table 4). Participants also reported strong proficiency in applying frequently used features in PowerPoint (Table 5).

However, preservice teachers’ proficiency dropped when it came to the advanced digital platforms and content creation-skills that went beyond routine tasks. The findings showed that student had limited experiences in using collaborative and open-source tools like wikis, blogs, or web publishing (Finding 3). Their proficiency was extremely low in using Excel functions (Finding 7). and some essential Word functions (Table 6). These findings reveal gaps in students’ digital literacy that could affect their ability to critically and creatively engage with digital content in educational contexts.

Notably, while participants rate themselves as competent users of digital technologies, their exposure to media creation tools is limited (Finding 3). The low percentages of students creating blogs, podcasts, or wikis suggest that their digital participation is largely as consumers rather than producers, which raises questions about their readiness to teach their future students how to create, critique, and distribute digital content—a key skill in 21st-century classrooms.

It is important to distinguish the digital consumer and digital producer as a lens to understand digital literacy. A digital consumer refers to an individual who uses, views, or applies digital content created by others. The list includes: (a) reading online articles or blogs; (b) watching videos on YouTube; (c) navigating through social media platforms; (d) downloading and using apps and (e) using educational platforms to access learning materials.

A digital consumer plays a passive in employing digital tools. They do not engage in creating new material or contributing back to the digital sphere. Many students (and even educators) fall into this category when they use technology mainly for searching, viewing, and downloading rather than creating or sharing (references), as evidenced by the findings of this study.

A digital producer is an individual who creates and shares digital content. An educator, as a digital producer, creates digital educational content, including videos, podcasts, presentations, websites, and multimedia learning materials. Shah (2024) coined the term “creator educator” to describe an educator who takes the role of a digital producer: “Simply put, they are educational content creators. Creator educators leverage technology and creative tools to produce educational materials such as videos, infographics, interactive presentations, podcasts, online courses, blogs and other multimedia resources to educate as well as entertain their viewers” (para 4).

Digital producers are active participants in the digital world. They are no longer passively consuming digital information but are actively creating and sharing. Digital producers contribute to the digital community, share their visions, and shape digital culture.

Digital literacy in a full sense requires that preservice teachers take the role of both digital consumer and digital producer – digital prosumer, a term coined by Toffler (1980) in his book *The* *Third Wave*. While digital consumers passively engage with existing content, digital producers actively create, modify, and share content, contributing to the digital knowledge landscape. The training of this dual role in teacher education programs provides a solid foundation for preservice teachers to integrate digital technology effectively in their future classrooms.

Another major concern is the preservice teachers’ lack of proficiency in advanced digital functions—especially in programs like Excel and Word, where proficiency is notably low in tasks such as mail merge, track changes, conditional formatting, or data analysis.

Pre-service teachers had limited knowledge of more advanced features **of Microsoft Word and Excel.** This should raise a concern because both tools are **essential productivity applications** in educational contexts. Microsoft Word, for instance, is not merely a typing tool; it offers features for **document formatting, collaborative writing (track changes), and organizing ideas through styles and outlines**—all valuable features in **teaching writing, academic composition, and digital literacy**. Microsoft Word differs from commercially developed writing programs which are primarily preprogrammed and follow the rigid algorithms. These canned programs are limited in cultivating student creativity. Microsoft Word, in contrary, is an open-ended writing program and can easily adapt to teaching various writing skills and writing projects. Equally importantly, Excel is not just a spreadsheet for data entry—it is a **powerful tool for teaching math concepts,** data interpretation, and analytical thinking. Features like **formulas, graphs, conditional formatting, and what-if analysis** can be applied to manipulate numerical information, observe relationships between variables, and identify patterns of data in all subjects-math, science, economy, and social studies classes. For an example, in a science class, students can use spreadsheet to keep track of data from an experiment. They then can formulate hypothesis of potential results, following a theory or a principle. Excel provides advanced functions to allow students to calculate, visualize, and manipulate variables, supporting or reputing their hypothesis, thus creating interactive and data-driven learning experiences. The limited familiarity with these features indicates that pre-service teachers may not be fully prepared to integrate such tools into their teaching practices, which will limit their ability to support student learning in writing, numeracy, and data literacy. Teacher education programs must be aware that it is crucial for preservice teachers to develop proficiency in using these productive applications as well as understanding of their **pedagogical implications** in the classroom.

The findings of this study showed that preservice teachers had the moderate understanding of digital ethics, including copyright, fair use, and appropriate educational use of online materials (Finding 8). These gaps may result in unintentional misuse of resources or a lack of confidence in teaching students about digital responsibility.

Without a clear understanding of digital ethics, students may unknowingly violate copyright laws. For example, they may use online materials without proper attribution or permission, leading to legal and professional consequences. Therefore, it is important for preservice teachers to gain a good understanding of **fair use policies** so that they can separate legally acceptable educational uses of copyrighted materials and possible violations. Beyond fair use, Knowledge of **Creative Commons licensing** and **open educational resources (OERs)** can help preservice teachers to responsibly use and share digital content and model ethical digital practices in their future classrooms.

Preservice teachers in this study are future teachers who are expected to serve as role models for their students. Teachers’ understanding of digital ethics directly influences how students engage with digital content. If teachers lack awareness of copyright laws, they may model incorrect practices, for example, when downloading copyrighted images, videos, and music without permission or using online content without proper citation. Only by developing awareness and knowledge in digital ethics, can teachers effectively guide students in understanding **academic integrity, plagiarism prevention, and responsible content uses** in a digital environment.

AI-generated content and digital tools are proliferating in educational landscapes, making it easier to remix and distribute materials. It is increasingly important to cultivate in preservice teachers awareness and understanding of digital ethics. Future teachers need to develop a strong foundation in digital ethics so that they can promote responsible digital citizenship in their future classrooms.

Although participants in this study most frequently self-identified as digital natives (M = 3.8), the findings indicate that their actual abilities only partial aligned with this perception. Their fluency in using communication apps and social media platforms (Finding 2) and comfort with accessing digital information (Finding 1) support the digital native classification. However, their limited experience with content production, advanced software use, and ethical awareness undermines it.

Rather than being digital natives in the full sense of the term, these pre-service teachers may be best described as **"**digitally fluent consumers**"**—highly comfortable navigating mainstream digital environments, but still developing the critical and creative skills required for more active and informed participation.

The concept of "digital natives," popularized by Prensky in 2001, assumes that young people who have grown up in a digital world are naturally fluent in technology. This assumption is problematic and can lead to detrimental consequences especially in teacher education programs, whose fundamental role is to train and produce future teachers.

The “digital native” statement overlooks possible differences in pre-service teachers’ experiences and skill levels. Not all teacher candidates enter teacher education programs with the same technological competencies. While many may feel comfortable using social media and entertainment apps, they often lack deeper skills in educational applications and digital content creation. If teacher education programs continue to hold the “digital native” mindset, it would reinforce a false sense of confidence in preservice teachers’ technology abilities. When preservice teachers are labelled as digital natives, both teacher education programs and students dismiss the need for necessary technology training to develop technology proficiency to an appropriate level. The findings of this study show the “digital native” designation may overgeneralize preserve teachers’ technological abilities. Teacher education programs must be aware that such a commonly held assumption may lead to gaps in training, leaving future educators unprepared to leverage digital tools for meaningful teaching and learning.

Preservice teachers’ technology proficiency is an essential component in integrating technology into K-12 curriculum to enhance student learning, as the TPACK model illustrates (Figure 1). The TPACK model is a technology integration framework widely applied in the field of education. It contains three components: technological knowledge (TK); pedagogical knowledge (PK); content knowledge (CK). Successful technology integration into the curriculum depends on the seamless interplay of knowledges in the three respective domains. The diagram below illustrates how the three types of knowledge relate to and intertwine with each other. Preservice teachers must develop required technology proficiency as a solid foundation for effective technology integration into instructional practices.

**Figure 1.** TPACK model (TPACK.org)

Teacher education programs must move beyond the **digital native myth** and take a more structured approach to develop pre-service teachers’ technology proficiency. Instead of assuming all teacher candidates possess advanced digital skills, teacher education programs should, first and foremost, **assess preservice teachers’ actual technology competencies and digital literacy levels** to identify areas for improvement. Teacher education programs should **structure training** following the TPACK model to equip future teachers with technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) for meaningful classroom implementation. Preservice teacher training should emphasize **critical digital literacy, ethical technology use, and advanced technology functions** with the goal to transform teacher candidates into efficient and critical digital prosumers. More importantly, teacher education programs need to foster a culture of **ongoing technology training** in emerging educational technologies to help future educators stay adaptable in a rapidly evolving digital landscape.

**Conclusion**

There is little doubt that children growing up in an environment where technology is ubiquitous absorb some level of technological proficiency and digital literacy from family, friends, media and society in general. However, simply being exposed to technology is no guarantee that they will attain proficiency in all aspects of the digital world, just as simply being raised in an English-speaking environment does not mean that every person can understand the specialized vocabulary of social groups such as professions or sports without specific training. Given the scope of technology in modern life, it is clear that digital literacy requires deliberate and focused learning.

Unfortunately, the myth of current students being naturally adept at using technology because they have grown up with it has resulted in a downturn of technology education in teacher training programs. The extent to which this has had an impact on the ability of future educators to teach their students effectively has been unclear. The findings of this pilot project indicate that inherent digital literacy is far from being a given in preservice teachers without specific exposure to technological pedagogy. For example, the participants in this study were generally but not uniformly more adept at being consumers rather than producers of technology content. Using the analogy of language, they showed they were better at listening than speaking, i.e., they are not fluent.

In a world that is becoming more technologically complex, digital fluency in the population at large cannot be left to random exposure in everyday life. Teachers are the obvious source for enhancing digital fluency in society overall but to do so they must master the knowledge and skills required. That places the onus on teacher education programs to strengthen their curriculum in technology in education courses.

**Limitations and Recommendations**

The present study has several limitations. First, as a pilot study the number of participants is naturally small, so outlier responses may have an undue influence on the results, although this possibility is low given the closed range for responses. Second, the sample was recruited from a university in the USA which may limit its generalizability. However, these American university students have grown up in the same pervasive technological world that underpins the concept of “digital native” globally. Finally, no digital skills tests were included in this project so the extent to which participants may have over/underestimated their abilities is not clear. Future research with larger samples to confirm/refute the findings of the present study using the same methodology should also incorporate standardized technology skills tests to help establish the relationship between perceived and actual digital literacy in preservice teachers.

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

**References**

American Library Association (2015, February 19). Digital Natives. https://www.ala.org/future/trends/digitalnatives.

Autry Jr, A. J., & Berge, Z. (2011). Digital natives and digital immigrants: getting to know each other. *Industrial and commercial training*, *43*(7), 460-466.

Bai, H. (2019). Preparing teacher education students to integrate mobile learning into elementary education. *TechTrends*, *63*(6), 723-733.

Benini, S., & Murray, L. (2014). Challenging Prensky’s characterization of digital natives and digital immigrants in a real-world classroom setting. *Digital literacies in foreign and second language education*, *12*, 69-85.

Bennett, S., Maton, K., & Kervin, L. (2008). The ‘digital natives’ debate: A critical review of the evidence. *British journal of educational technology*, *39*(5), 775-786.

Bullen, M., Morgan, T., Belfer, K., & Qayyum, A. (2009). The net generation in higher education: Rhetoric and reality. *International Journal of Excellence in E-Learning*, *2*(1), 1-13.

Creighton, T. B. (2018). Digital Natives, Digital Immigrants, Digital Learners: An International Empirical Integrative Review of the Literature. *Education Leadership Review*, *19*(1), 132-140.

Dede, C. (2005) Planning for Neomillennial Learning Styles: Implications for Investments in Technology and Faculty. In D. Oblinger, and Oblinger, J. (Ed.), *Educating the Net Generation* (pp. 15.1-15.22). Washington DC: Educause.

Dinçer, S. (2018). Are preservice teachers really literate enough to integrate technology in their classroom practice? Determining the technology literacy level of preservice teachers. *Education and information technologies*, *23*(6), 2699-2718.

Gros, B., Garcia, I., & Escofet, A. (2012). Beyond the net generation debate: A comparison of digital learners in face-to-face and virtual universities. *International Review of Research in Open and Distributed Learning*, *13*(4), 190-210.

Guo, R. X., Dobson, T., & Petrina, S. (2008). Digital natives, digital immigrants: An analysis of age and ICT competency in teacher education. *Journal of educational computing research*, *38*(3), 235-254.

Cummings Hlas, A., Conroy, K., & Hildebrandt, S. A. (2017). Student teachers and CALL: Personal and pedagogical uses and beliefs. *Calico Journal*, *34*(3), 336-354.

Jeffery, L. (2019). *Preservice Teachers' Perceptions of Readiness for Teaching in a 1: 1 Classroom*. [Doctoral dissertation]. University of New Mexico. https://digitalrepository.unm.edu/educ\_teelp\_etds/291

Judd, T. (2018). The rise and fall (?) of the digital natives. Australasian Journal of Educational Technology, 34(5), 99-119.

Kara, S. (2021). An Investigation of Technological Pedagogical and Content Knowledge (TPACK) Competencies of Pre-Service Visual Arts Teachers. *International Journal of Technology in Education*, *4*(3), 527-541.

Karjanto, N. (2021). Calculus and digital natives in rendezvous: wxMaxima impact. *Education Sciences*, *11*(9), 490. doi: 10.3390/educsci11090490

Kelly, F. S; McCain, T. & Jukes, I. (2009). Teaching the digital generation: No more cookie-cutter high schools. Melbourne, Vic: Hawker Brownlow Education.

Kennedy, G., Judd, T., Churchward, A., Gray, K. & Krause, K. (2008) First-year students’ experiences with technology: are they really digital natives? Australasian Journal of Educational Technology, 24(1), 108–122.

Kirschner, P. A., & De Bruyckere, P. (2017). The myths of the digital native and the multitasker. *Teaching and Teacher education*, *67*, 135-142.

Kirschner, P. A., & De Bruyckere, P. (2017). The myths of the digital native and the multitasker. *Teaching and Teacher education*, *67*, 135-142.

Margaryan, M., & Littlejohn, A. (2008). Are digital natives a myth or reality? Students’ use of technologies for learning. Caledonian Academy, Glasgow Caledonian University, UK. Retrieved from http://www.academy.gcal.ac.uk/anoush/documents/ DigitalNativesMythOrReality-MargaryanAndLittlejohn-draft-111208.pdf

Oblinger, D., & Oblinger, J. (2005). Is it Age or IT? First Steps Toward Understanding the Net Generation. In D. Oblinger, and Oblinger, J. (Ed.), *Educating the Net Generation* (pp. 2.1-2.20). Washington DC: Educause.

Oblinger, D., & Oblinger, J. (2005). Technology and Learning: Expectations of the Net Generation. In D. Oblinger, and Oblinger, J. (Ed.), Educating the Net Generation (pp.3.1-3.7). Washington DC: Educause.

Prensky, M. (2001a). Digital natives, digital immigrants, part 1. On the Horizon, 9, 3–6. http://dx.doi.org/10.1108/10748120110424816

Prensky, M. (2001b). Digital natives, digital immigrants, part 2: Do they really think differently? On the Horizon, 9(6), pp. 1–6. https://doi.org/10.1108/10748120110424843

Puybaraud, M., & Hahn, H. (2012). Digital natives: A tech-savvy generation enters the workplace. *WorkDESIGN Magazine*, *2017*.

Roberts, G. R. (2005). Technology and Learning Expectations of the Net Generation. In Oblinger, D., & Oblinger, J. (Eds.), *Educating the Net Generation* (pp. 3.1-3.7). Washington DC: Educause.

Smith, E. E., Kahlke, R., & Judd, T. (2020). Not just digital natives: Integrating technologies in professional education contexts. *Australasian Journal of Educational Technology*, *36*(3), 1-14.

Tapscott, D. (2009). *Grown up digital: How the net generation is changing your world*. New York: McGraw-Hill.

Toffler, A. (1980). The Third Wave. New York: Morrow

Wallace-Spurgin, M. (2020). Implementing Technology: Measuring Student Cognitive Engagement. *International Journal of Technology in Education*, *3*(1), 24-38.

Windham, C. (2005). The Student’s Perspective. In D. Oblinger, and Oblinger, J. (Ed.), *Educating the Net Generation* (pp. 5.1-5.16). Washington DC: Educause.

|  |
| --- |
| **Table 1. Online Information Search, Uploading, and Downloading (N=44)** |
| Please rate your proficiency in accessing, searching and sharing online information (1-10) | Mean | Std Deviation |
| I can use various search engines to search for information | 8.7 | 2.22 |
| I can locate the information I need. | 8.82 | 1.99 |
| I can identify appropriate keywords to find information. | 8.73 | 1.92 |
| I can download information and save it in an organized way on my desktop or in a folder. | 8.45 | 2.46 |
| I search Google Scholar for academic sources. | 8.2 | 2.74 |
| I can organize downloaded information in a way that is easy to navigate and find later. | 8.39 | 2.19 |
| I can find scholarly works relevant to my academic study. | 8.07 | 2.7 |
| I can download online music. | 7.48 | 3.09 |
| I can upload music to a platform. | 6.5 | 3.15 |
| I can download online videos. | 7.66 | 2.63 |
| I can search for and find online groups related to subjects that interest me. | 7.8 | 2.67 |

|  |
| --- |
| **Table 2. Digital Communication (N=44)** |
| Please rate your level of proficiency in using digital communication tools (1-10): | Mean | Std Deviation |
| I am familiar with using email to send and receive messages. | 9.23 | 1.86 |
| I am able to tweet and retweet on Twitter. | 8.18 | 3.12 |
| I am confident in my ability to make a presentation on Zoom. | 7.68 | 3.12 |
| I am able to use Facebook Messenger to communicate with my friends. | 8.27 | 3.06 |
| I am able to post and comment on a blog. | 8.77 | 2.23 |
| I am proficient in using Instagram. | 8.7 | 2.83 |
| I am skilled in using instant messaging apps like WhatsApp, Facebook Messenger, Slack, and Microsoft Teams. | 8.36 | 2.66 |
| I am able to use video conferencing tools like Zoom, Google Meet, Skype, and FaceTime. | 9.16 | 1.87 |
| I am able to use WhatsApp for messaging and calling. | 7.02 | 3.29 |
| I am knowledgeable about using hashtags on Twitter. | 8.5 | 2.44 |
| I use audio-based communication platforms like podcasts to listen and communicate. | 8.45 | 2.41 |
| I have experience in using Snapchat. | 9.23 | 2.15 |
| I am able to use Skype for messaging and video calls. | 8.07 | 2.82 |
| I am able to use FaceTime for video calls on Apple devices. | 9.05 | 2.27 |

|  |
| --- |
| **Table 3. Digital Content Creation (N=44)** |
| Please indicate your experiences in creating digital content | Yes | No |
| Have you created a Facebook page before? | 84.09%(37) | 15.91%(7) |
| Have you created a blog before? | 18.18%(8) | 81.82%(36) |
| Do you have a Wiki page? | 0.00%(0) | 100.00%(44) |
| Have you contributed to Wikipedia before? | 9.09%(4) | 90.91%(40) |
| Have you published a webpage before? | 25.00%(11) | 75.00%(33) |
| Have you edited editing photos? | 88.64%(39) | 11.36%(5) |
| Have you edited videos? | 79.55%(35) | 20.45%(9) |
| Have you designed a newsletter before? | 25.00%(11) | 75.00%(33) |
| Have you created a video before? | 84.09%(37) | 15.91%(7) |
| Have you created a podcast before? | 25.00%(11) | 75.00%(33) |
| Have you posted a video on YouTube before? | 56.82%(25) | 43.18%(19) |
| Have you created a PowerPoint presentation before? | 97.73%(43) | 2.27%(1) |

|  |
| --- |
| **Table 4. Data Storage and Sharing (N=44)** |
| Rate your proficiency in storing and organizing digital content (1-10): | Mean | Std Deviation |
| I am knowledgeable and skilled in storing and sharing various types of information (text, pictures, audio, and video) using online drives. | 8.02 | 2.46 |
| I am proficient in using Google Drive for storage and sharing of information. | 8.43 | 2.15 |
| I am able to create and collaborate on documents using Google Docs. | 8.75 | 2.08 |
| I am able to use Dropbox for storage and sharing of information. | 6.36 | 3.39 |
| I am able to use OneDrive for storage and sharing of information. | 7.75 | 2.71 |
| I am proficient in using Microsoft OneDrive for storage and sharing of information. | 7.8 | 2.74 |
| I am able to convert information into various formats, such as PDF to Word, and different graphic, audio, and video formats. | 8.27 | 2.45 |

|  |
| --- |
| **Table 5. Engaging in Online Platforms** |
| Rate your proficiency in using online platforms | Mean | Std Deviation |
| I have proficiency in using online tools or software. | 8.27 | 2.45 |
| I am comfortable with using Microsoft Teams for online meetings and collaboration. | 7.02 | 2.89 |
| I am comfortable with using Zoom for online meetings and collaboration. | 8.55 | 2.4 |
| I am comfortable with using a discussion board for online communication and collaboration. | 8.2 | 2.68 |
| I am comfortable with using Facebook groups for online communication and collaboration. | 6.82 | 3.45 |
| I have knowledge and skills in online gaming. | 6.57 | 3.32 |
| I am function well in a virtual reality environment. | 6.86 | 3.18 |

|  |
| --- |
| **Table 6. Proficiency in Using Microsoft PowerPoint (N=44)** |
| Please rate your proficiency in using each feature below in PowerPoint (1-10) | Mean | Std Deviation |
| Inserting videos | 8.23 | 2.351 |
| Recording voice | 7.43 | 3.015 |
| Creating animations | 7 | 3.206 |
| Designing a background | 8.57 | 1.885 |
| Advancing slides automatically | 7.61 | 2.764 |
| Inserting web links | 8.05 | 2.728 |
| Applying SmartArt | 5.14 | 3.387 |
| Inserting Word or Excel files onto the slide | 6.91 | 3.079 |
| Inserting music | 6.59 | 3.237 |
| Editing photos (e.g., changing color, size, or visual effects) | 7.86 | 2.775 |

|  |
| --- |
| **Table 7. Proficiency in Using Microsoft Word (N-44)** |
| Please rate your proficiency in using each feature below in Word (1-10): | Mean | Std Deviation |
|  Using pre-designed styles | 6.27 | 3.385 |
| Adding a table | 7.18 | 2.839 |
| Creating a table of contents | 5.89 | 2.814 |
| Applying track changes | 3.16 | 2.753 |
| Performing a mail merge | 3.5 | 3.231 |
| Inserting footnotes and endnotes | 6.89 | 3.215 |
| Creating diagrams | 5.68 | 3.367 |
| Inserting headings | 7.59 | 2.888 |
| Customizing ribbons | 3.39 | 2.863 |
| Modifying quick access toolbar | 5 | 3.264 |

|  |
| --- |
| **Table 8. Proficiency in Using Microsoft Excel (N=44)** |
| Please rate your proficiency in using each feature below in Excel (1-10): | Mean | Std Deviation |
| Entering data | 7.09 | 3.416 |
| Formatting cells | 5.34 | 3.563 |
| Performing calculations | 5.55 | 3.637 |
| Using built-in formulas | 4.91 | 3.496 |
| Sorting data | 5.39 | 3.479 |
| Using conditional formatting | 4.25 | 3.111 |
| Conducting what-if analysis | 3.89 | 3.258 |
| Generating charts and graphs | 5.36 | 3.335 |

|  |
| --- |
| **Table 9. Student Perceptions, Awareness, and Competences Related to Digital Literacy (N=44)** |
|  | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Mean |
| I possess proficiency in utilizing digital technologies to solve problems and achieve goals. | 2.3%(1) | 4.5%(2) | 13.6%(6) | 40.9%(18) | 38.6%(17) | 4.09 |
| I consider myself a digital native who is skilled in using various digital tools and platforms. | 2.3%(1) | 9.1%(4) | 25%(11) | 34.1%(15) | 29.5%(13) | 3.8 |
| I believe that technology has both positive and negative impacts on society. | 4.5%(2) | 2.3%(1) | 2.3%(1) | 25%(11) | 65.9%(29) | 4.45 |
| I regularly evaluate the credibility of information before using it. | 4.5%(2) | 4.5%(2) | 20.5%(9) | 43.2%(19) | 27.3%(12) | 3.84 |
| I am able to assess the quality and reliability of information. | 2.3%(1) | 2.3%(1) | 13.6%(6) | 45.5%(20) | 36.4%(16) | 4.11 |
| I have a good understanding of copyright laws and how they apply to technology uses. | 4.5%(2) | 4.5%(2) | 15.9%(7) | 40.9%(18) | 34.1%(15) | 3.95 |
| I understand the principles of fair use policy and how they apply to technology use. | 2.3%(1) | 6.8%(3) | 29.5%(13) | 27.3%(12) | 34.1%(15) | 3.84 |
| There is no limit for me to use online information (text, videos, and music) for education purposes. | 4.5%(2) | 15.9%(7) | 18.2%(8) | 34.1%(15) | 27.3%(12) | 3.64 |
| I am aware of the issue of the digital divide and its impact on access to technology. | 4.5%(2) | 9.1%(4) | 13.6%(6) | 34.1%(15) | 38.6%(17) | 3.93 |
| I am knowledgeable about online safety issues and take steps to protect myself online. | 4.5%(2) | 2.3%(1) | 11.4%(5) | 31.8%(14) | 50%(22) | 4.2 |
| I believe that using digital technologies for personal uses alone is limiting their potential benefits. | 6.8%(3) | 11.4%(5) | 25%(11) | 31.8%(14) | 25%(11) | 3.57 |
| I believe that digital technologies have the potential to enhance student learning and should be integrated into university courses. | 9.1%(4) | 0%(0) | 15.9%(7) | 31.8%(14) | 43.2%(19) | 4 |