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The Role of Teacher Education in Improving Digital Literacy: A Pre-Service Teacher Case Study

Background for the Study

Technology has become essential in 21st-century education, serving as a critical component of learning inside and outside the classroom, enabling students to become independent learners and enhancing teaching and learning (Ahmadi, 2018; Gilakjani, 2017; Wiraningsih & Santosa, 2020). Teachers should have Digital Literacy (DL) skills and use its techniques to help their students learn how to solve problems in digital environments, given the fast-paced development of digital technologies (Sadaf & Johnson, 2017). Teacher education programs (TEPs) are crucial in equipping teachers with pedagogical skills, content mastery, and effective integration of technology into their teaching practices, specifically for pre-service teachers (PSTs) before they interact with students (Jan, 2017).

In the current study, we will utilize the term “student” to refer to students in grades K-12 and will utilize the terms “Pre-service teacher” and “PST” to refer to candidates within a TEP. In addition, when speaking of the PSTs who took part in this study, the term “participant” will be utilized. Moreover, this study assesses one TEP's role in enhancing PSTs' understanding of DL, without addressing teaching methods, school quality impact, or other multiliteracies.

Statement of Problem

Without teachers who are knowledgeable about using technology to achieve learning goals, technology cannot be used effectively in the classroom (DeCoito & Richardson, 2018). Although the use of technology in the classroom is growing, the goal should still be to improve learning through its use. However, regardless of the increasing interest in DL in educational

policy, many teachers feel unprepared to effectively support their students' development of DL skills (Sadaf & Johnson, 2017). According to Windiarti et al. (2019), teachers are still facing numerous challenges when attempting to use e-learning in their lessons. Thus, it is vital that teacher education programs assist PSTs in their ability to support the effective use of DL in their future classrooms. Also, understanding the PST's perception of their own DL level can be important for policymakers and TEPs to enhance the curriculum. Thus, this study seeks to identify the role of current technology-related courses on PST's comfort with their DL level and readiness to use it in their future classrooms

Guiding Research Question

The question under study is "What is the current level of DL in PSTs enrolled in one TEP in the western U.S. considering the progress of the modern world and today's technologies?" Thus, the purpose of this study is to determine the current level of PST's knowledge of DL, their self-efficacy regarding the implementation of DL in their future classrooms, and how they feel this knowledge and self-efficacy have been impacted by their teacher education coursework.

Delimitations and Limitations

This research will assess the role of one TEP in improving PST's understanding of DL and will not address the teaching methods and the impact they may have on school quality. It will not consider PST's backgrounds and other modes of multiliteracy or different contexts of DL.

Definition of Terms and Concepts

Digital literacy: The term DL, or new media literacies, describes meaning-making practices that are accomplished via digital media (Akayoglu et al., 2020). This meaning-making

includes the ability to collect information from digital technologies and to evaluate, process and share it effectively, critically, safely, and ethically (Murtafi'ah & Putro, 2019).

Importance or Significance of the Study

Despite growing interest in DL, many teachers feel inadequately prepared to effectively support students in DL skills (Sadaf & Johnson, 2017). Teacher education programs can support the effective implementation of DL in classrooms by teaching PSTs how to integrate DL into the PK-12 classroom and engaging them through DL practices. This study can enable teacher educators to consider developing DL for PSTs.

Review of Related Literature

These days, there are many different text formats students may encounter in the digital environment such as paragraphs, graphs, pictures, charts, etc. (Seok & DaCosta, 2016). Additionally, screen-based text formats employ various elements (such as sounds, images, writing, movement, and animation) and have grown more popular than paper-based texts (Ulu et al., 2017). Finally, there is an expanding understanding of how the term "texts" is being defined by both practitioners and researchers to include formats such as video, audio, and images (New London Group, 1996). Based on the variety of text structures and multi-modal elements, it is necessary to create new literacies to adapt from print to digital texts.

Teachers who set an example for their students and prepare them for life are encouraged to be able to adapt to changing technology. Therefore, it is crucial to ensure that teachers understand how to read digital text. This literature review will highlight recent findings regarding the necessity of, teachers' preparedness and willingness to, and students' attitudes toward using DL.

Digital Literacy and Technology

The fact that digital texts are produced electronically and are multimodal (combining text with audio, video, image, and hypertext) makes them more interactive than printed texts and gives readers a different experience (Manalu, 2019). The term "literacy in the 21st century" is frequently used to describe DL (Jan, 2017). Ozden (2018) defines DL as the capability to access information in digital form. Because technology is present in every aspect of life, literacy in digital texts is inevitable (Tamam & Asbari, 2022). Khan et al. (2022) believe that "Digital literacy, also known as virtual learning, has the potential to improve lifelong learning". Murtafi'ah and Putro (2019) describe DL as the capacity to search for accurate information online and to conduct oneself wisely and securely in digital environments. DL refers to the ability to collect information from digital technologies, and to evaluate, process and share it effectively, critically, safely, and ethically. In today's increasingly technological and connected society, DL should be purposefully taught.

One needs to be digitally literate for learning, personal development, communication, employment, and collaboration (Lee, 2014). Giebelhausen (2015) believes the introduction of digital reading devices has also prompted educational institutions all over the world to transition to paperless classrooms. However, the success of the blended learning environment is determined by the learners' DL skills and practices, which is another reason DL is acknowledged as a fundamental component in these contexts (Tang & Chaw, 2016). As the world transitions towards paperless systems, DL becomes pivotal for both the educational process and future career prospects.

Teachers and students who want to be literate in today's world should have the ability to use these technologies and know how digital media has affected society. The best option is to use them in addition to, or as a replacement for, the resources teachers already have (Manalu, 2019). Having a quality professional teacher development program can be helpful for developing a high-quality teaching force. As a result, the developmental program must include technology integration in the classroom (Jan, 2017). Thus, in order for teachers to contribute the development of DL, teachers (including PSTs) must be digitally literate themselves and be prepared to integrate DL into their classrooms.

Digital Literacy Skills in the Classroom

The widespread availability of technology has truly brought people into the digital world, and one of the most significant consequences is that people, and students in particular, spend an increasing amount of time accessing digital tools (Bana,2020). Many students spend their free time on mobile devices and interactive social networking platforms like Twitter and Facebook which have become an integral part of their daily lives (Akram & Kumar, 2017). So, due to the abundance and diversity of available information, students should be able to engage with digital text as a new form of literacy.

Students can take advantage of technology-based activities when they are aligned with the learner's needs and interests (Gilakjani, 2017). Students are also interested in learning and using digital tools in their personal lives. Laeli et al. (2020) state that students are sometimes better at using specific applications than their teachers. As a result, teachers must become familiar with the nature and strategies of digital tools (Pardede, 2019b) and should be prepared with professional skills that encompass both teaching and technical expertise (Gilakjani, 2017).

Furthermore, teachers must be prepared to adjust their instructional methods and introduce new strategies to students, while DL skills can be reciprocally taught between teachers and students.

Younger users who are more tech-savvy tend to have more favorable attitudes regarding digital reading (Pardede, 2019b). These findings supported Gilbert's (2017) idea that students are more motivated to read digital texts than printed texts. A study by Manalu (2019) shows that PSTs agreed that learning with digital texts is effective, facilitates comprehension improvement, and increases learning achievement while also indicating they personally often read digital texts more than printed texts. This result supports findings that digital texts were preferred to printed texts by students (Carroll et al., 2016). Due to the rise of the popularity of digital texts among students, it is necessary to teach DL skills. Most students indicate appreciation of specific instruction related to reading and creating visual texts (Lim, 2018). We should incorporate DL skills into the educational setting to improve students' abilities and capture their attention.

Teacher Attitudes

A teacher who is digitally literate will be able to critically consider when, why, and how technology enhances learning and teaching (Hall et al., 2014). Research investigating teachers' attitudes toward DL indicates that teachers have a positive attitude toward the practice of reading digital text (Laeli et al., 2020) similar to the positive attitudes students often hold toward digital texts.

Laksani's study (2019) on teachers' perception of DL demonstrates a positive commitment to accepting DL in the classroom because it provides many benefits for both educators and students in class activities. To foster students' ability to manage and filter information from technology, it is essential for teachers to have a positive attitude toward DL

and be proficient in its use (Pratolo & Solikhati, 2020). Teachers need to be aware of new literacy in digital text (Laeli et al., 2020). Moreover, there is a growing global need for teaching and learning DL. In recognition of this need, the International Society for Technology in Education (ISTE) highlights the importance of teachers using digital tools and media to maximize student learning and to provide positive models for students (ISTE, 2015).

Because digital texts have fundamentally altered how students engage with content, their use necessitates new approaches to learning and teaching (Pardede, 2019b). Therefore, educators must also learn about the characteristics and practices of utilizing digital tools. According to Albion et al. (2015), teacher education programs should adopt current educational requirements because of the rapid development of technology and its integration into education. Students will miss out on technology implementation and integration opportunities in school if teachers are unprepared to assess their students' abilities (Hartell, 2017). In addition, teachers must be digitally literate to critically assess technological tools and platforms for safe, intelligent, and beneficial use (Akayoglu et al., 2020). Teachers should stay informed of technological developments if they are to prepare students for their future lives and act as role models. As a result, teachers must be proficient in DL and gain more experience engaging with digital texts to assist students in the classroom, which can be accomplished by attending regular workshops or courses on teaching how to read digital text (Laeli et al., 2020).

Digital technologies have become widespread, revolutionizing traditional teaching methods. Students are more likely to use digital text and have a positive view of using digital tools in schools and at home (Gilbert, 2017; Pardede, 2019b; Manalu, 2019). Many teachers believe that DL is important to their classes and have a good attitude toward using it (Laksani, 2019; Laeli et al., 2020; Pratolo & Solikhati, 2020). However, some teachers still feel

uncomfortable using and teaching DL in their classrooms. In addition, students sometimes outperform teachers when it comes to controlling and being creative with digital technology (Akayoglu et al., 2020; Laeli et al., 2020). Thus, teachers need DL skills to navigate and learn constantly changing technologies.

Methodology

A bounded case study was utilized which allowed the researcher to center on the experiences and perspectives of a small group of PSTs in order to interview them about their understanding of DL and its uses in the classroom. Creswell and Poth (2018) recommend a case study as a methodology if the problem to be studied "relates to developing an in-depth understanding of a 'case' or bounded system" (p. 496). This study is particularly suitable for a case study design because it is a bounded system, it is contextual, and it is a study of the process (Merriam, 1998). Data were collected from PSTs participating in a technology-related course at a land grant university in the northwestern U.S. The participating PSTs were interviewed to assess their current level of DL, explore its applications, and identify the challenges of integrating it within the PK-12 classroom.

Sampling Procedures

Participants for this study were three undergraduate students (PSTs) from a technology integration course at a land grant university in the northwestern US. Participants were purposefully chosen using convenience sampling due to the course's emphasis on DL, compounded by its status as a compulsory component for all education majors at the university. To ensure anonymity, pseudonyms were assigned to each participant. The researchers coordinated with the course instructor for a 16-week program, where each week focused on a

unique topic. Each class session lasted about two hours. Discussions on DL were held during one class session in the semester. Other topics covered included participant's data privacy, universal design for learning, Artificial Intelligence, and scaffolding instruction with technology.

Table 1: *Participant Demographics*

Name	Gender	Major	Year of school
Lexi	Female	Elementary Education	Freshman
Katherine	Female	Secondary Education	Senior
Wyatt	Male	Elementary Education	Senior

Data Collection Strategy

Participants engaged in recorded one-on-one semi-structured interviews with the researcher. Interviews were then transcribed verbatim to preserve the participant's voices (Morris, 2015). The use of a semi-structured interview protocol provided consistency of questions for all participants while also allowing the researcher to ask additional probing or clarifying questions as needed (Bailey, 2018).

Data Analysis Strategies

Data coding and analysis were approached through a process consisting of four iterative cycles: The Inspection Cycle, Coding Cycle, Categorization Cycle, and Modeling Cycle, with memo-writing inherent to the entire analysis process (Kalpokaite & Radivojevic, 2019). This method was selected as it is appropriate for analyzing diverse types of qualitative data and

provides opportunities for the researcher to engage in both inductive and deductive analysis, thus connecting findings to the existing literature while also providing opportunities for unanticipated findings to emerge (Kalpokaite & Radivojevic, 2019).

To gain an overall perspective of the study, the recorded voice of participants was listened to several times, with noteworthy or significant words or phrases underlined while reviewing the transcripts. During the initial Coding Cycle, common perceptions mentioned by the PSTs were identified and assigned the same color, such as using red for keywords related to "safety". Subsequently, the codes and their respective colors were organized into a table, with some codes moved between columns. In the Categorizing Cycle, broader categories were created, and each code was placed within one of these categories. Some codes were grouped and category names were updated to ensure consistency with all codes. Finally, the most evident categories with the largest number of instances were identified as themes.

Methods of Achieving Authenticity, Trustworthiness, Credibility, and Transferability

Several strategies were employed to ensure the validity of data analysis. First, an effort was made to mitigate personal biases, particularly those stemming from researchers' teaching backgrounds. Secondly, the social constructivism framework in this study leads the researcher to look for the complexity of the participants' views rather than narrow the meanings into a few categories. It further involves the negotiation of meaning between the researcher and the participants (Savin-Baden & Major, 2023). Thus, multiple participant perspectives were considered to identify common conceptions, and the transcript was meticulously reviewed multiple times to systematically organize codes and themes to discern underlying constructs.

Reflexivity promotes self-awareness of the researcher's role, location, bias, and subjectivity within the research topic, relationship to the participant, and research process. One way to engage reflexivity was by asking these questions of myself:

1. How do my past experiences, personal characteristics, and interpretive lens shape my interaction with the participants and interpretation of a phenomenon?
2. How do I see my role/position in the research and making meaning process—biased or collaborative subjectivity? How will I make this transparent?

During my academic years, I took various courses about technology and its relationship to classes, but I was certain that many of them did not apply to students because they use a variety of digital platforms such as social media, Instagram, video games, and so on. Furthermore, those courses were purely theoretical and were of little help to me because I couldn't use them in the classroom. I am aware that having non-useful courses that I took before may create a perception of DL courses at the current university, so I try to control this bias and avoid judging the participant's views and learning by purposefully locating myself as an outsider.

Within this study, I utilized a variety of processes to enhance the credibility and dependability of this research. I explain how participants expressed themes differently to indicate shared or overlapping aspects of a concept, a category, or a process. I also compare the themes in the literature to analyze and "test" them, further supporting the results of the analysis. This benefits credibility and dependability. Credibility addresses the "fit" between respondents' views and the researcher's representation of them (Tobin & Begley, 2004). Enlisted the help of two professors and one professional colleague to review the coding process and themes, which provided an opportunity for triangulation and accountability to achieve dependability, steps were

taken to ensure that the research process was logical, traceable, and documented (Tobin & Begley, 2004).

Findings

This study investigated the current level of DL in PSTs enrolled in one TEP. The following themes emerged from the analysis of the interviews: concerns, considering challenges, advantages, and future decisions. In the following section, themes are delineated and quotes from participants are presented to preserve the essential aspects of their experiences.

Concerns

Upon reviewing the transcripts, concerns emerged as the primary theme. This section addresses sub-themes such as ethics, legality, and appropriateness of using DL in teaching. All the participants mentioned that it is important to consider which digital tools are safe to use. They have concerns about using digital tools, including student safety, privacy laws, and copyrights. Lexi expressed her concerns regarding copyright laws, stating: "*I watched a video of people who have gotten in trouble with the people who owned materials ... I thought if you were using the material for educational purposes, it is pretty much just ok.*"

Katherine shared her concerns about her responsibility as a teacher, stating, "*I am kind of comfortable, but I am also a little scared of it. I want to make sure that I am using the Digital resources correctly because I have a responsibility as an educator, and I want to make sure that I am fulfilling this responsibility ethically*." She also shared her concerns while reflecting on how her understanding of DL has evolved throughout the program, noting significant changes in her awareness of the restrictions associated with using digital outlets. Specifically, she highlighted issues related to copyright, privacy laws, and the importance of obtaining proper permissions.

"Once I get good at them, I think I will be very comfortable with them. Right now, I am uncomfortable still...Getting good support materials would be my biggest concern." Wyatt stated to describe his comfort level and concerns.

Teachers may encounter obstacles that prevent them from using technology effectively, such as a lack of confidence or proficiency, nervousness while introducing new technologies, and lack of time for professional development that supports instructors (Smith, 2021; DeCoito & Estaiteyeh, 2022). Participants in this study indicated similar concerns regarding using DL in their future classrooms. Based on the concerns shared by participants within this study, TEPs should ensure that PSTs are not only familiar with the use of digital tools but are also fully aware of associated legal and ethical guidelines for their use. This can include analysis of case studies and strategies for maintaining student privacy in the digital world.

Challenges

"*...it can pose a challenge if [DL is] not used in a way that pushes students to do their own work and make sure they are using all their skill sets and not just depending on the technology."* Katherine said. One of the important factors when considering using digital tools includes the challenges teachers and PSTs face. Many PSTs lack information and knowledge of DL (Alexander et al., 2016), making it difficult for them to implement effective DL curricula. In this section, some sub-themes such as defining DL, fluency of DL, inappropriate use, and support are addressed. Two participants identified the changing definition of DL and the tools that can be utilized as a challenge for educators, with Lexi stating that teachers must stay up to date by "*continuing to do research*" on DL tools. PSTs in the study also shared other challenges they might face as teachers engaging their students in DL.

Advantages

PSTs often have a positive attitude regarding the adoption of DL and think it is crucial for their students (Gretter & Yadav, 2018) and, in alignment with this, the PSTs in this study mentioned some of the DL advantages associated with DL. Sub-themes addressed in this section are related to proficiency, technology culture (both as student expectations, and societal demands), and DL across the curriculum. For example, Katherine believes DL is helpful for both teachers and students. It is helpful for students as they are evolving with DL, and it is helpful for teachers to be proficient and learn about different digital areas. Lexi mentioned: *"... this class really helped with being more proficient myself and just learning about different digital areas that I can involve in teaching."*

Participant comments regarding challenges and advantages suggest that the TEP should consider how to increase their support of PSTs' digital literacy through on-going scaffolded support throughout the program. This could include hands-on workshops, engagement with local practitioners who are effective users and teachers of DL, and integration of DL across the curriculum. This last suggestion, in particular, would support PSTs in understanding how to effectively utilize DL within multiple subject areas to support student meaning-making and critical thinking.

Future decisions

The purpose of having digital-related courses for PSTs in universities is first to teach them what DL is and help them understand the ethical and legal issues around finding, evaluating, and using information including sharing information back to digital spaces. Additionally, it is essential to ensure that all PSTs are equipped with the skills and knowledge

necessary to effectively integrate DL into their own classrooms. It is important to know about PST's decisions regarding how to use DL in class in the future. Here is Lexi's thought regarding using DL as a future teacher: "*I want to include DL in my classroom as much as possible... and to be an effective teacher you need to... have a good understanding of it yourself.*" Wyatt, also stated: "*I'll definitely give my students the same things I have given in this class....*" These observations connect with existing observations that future instructional decision-making of PSTs is influenced by experiences in their educator preparation programs (Kaya, 2018).

In considering the information shared by participants regarding how they plan to engage students with DL in their future classrooms, inclusion of opportunities to practice decision making through simulations, case studies, and purposefully created reflective assignments may provide PSTs with increased knowledge of selection and implementation of DL tools. As previously mentioned, such opportunities should be integrated across the TEP curriculum to support PSTs in seeing DL as a tool across content areas.

Summary of Findings

In analyzing the participants' responses, four interconnected themes emerged, all linked through the DL courses in which the PSTs were engaged. The themes summarized in this section were concerns, challenges, advantages, and future decisions. The theme of concern determines the apprehensions PSTs share regarding using Digital tools in their classrooms. The second theme of considering challenges shows the obstacles they face in using digital tools. The themes of advantages determine the positive perspective of knowing DL skills and the last theme, future decisions, indicates the student's decision to use DL in their classrooms in the future. The findings suggest that a holistic approach to DL in which it is integrated across the curriculum to emphasize the ethical and legal use of the various tools available and provide continuous

scaffolded opportunities for PSTs to engage in DL practices to support their knowledge, proficiency, and confidence in DL.

Discussion

This study aims to enhance understanding of the current level of DL in PSTs enrolled in one TEP. The term DL describes meaning-making practices via digital media (Akayoglu et al., 2020), encompassing the ability to collect, evaluate, process, and share information effectively, critically, safely, and ethically. This study analyzes interview data from three participants, revealing four key themes: concerns, challenges, advantages, and future decisions. Results show participants are thinking about the challenges and responsibilities of their student's safety and privacy.

The first theme, concerns, shows the participants' worries about the problems they are faced with or will face in the future regarding technology use in classrooms. In addition, participants are not confident about their ability to engage their future students with DL. Although it is crucial to integrate technology in the classroom, their lack of confidence will create challenges for both teachers and students. The theme of challenges refers to the obstacles and problems they think digital tools will bring them. Therefore, they need to receive training that will equip them to instruct students utilizing DL. The advantages provided a desire in participants to use DL in their future classes, which forms the last theme of future decisions, describing the PST's decision to use DL in their future classrooms.

Teachers must be digitally literate to provide students with the skills and information they will need to succeed in a technologically dominated world (Mantiri et al., 2019). When teachers are familiar with multimodal texts, they're more likely to use them in the classroom,

which can enhance students' abilities to use digital tools for reading, writing, and communication through speaking, listening, and viewing (Ybarra, 2023).

In the present study, PST's felt that, in comparison to the beginning of the semester, their awareness of DL had increased but they still feel uncomfortable about it and have some worries about getting into trouble with the students' parents and administration or concerns about copy rights and privacy laws. When it comes to exploring and disseminating information via the internet, Murtafi'ah and Putro (2019) define DL as the ability to encounter valid information and behave wisely and safely in online activities. Educators have a social and professional responsibility to be digitally literate (Widana, 2020). Teachers must be digitally literate to provide students with the skills and information they will need to succeed in a technologically dominated world (Mantiri et al., 2019). In DL settings, teachers may encounter various challenges, including understanding effective utilization of technology and feeling confident in using digital tools to effectively communicate with students about them. Participants in this study indicated a desire to support their future students in becoming digitally literate citizens, while also sharing concerns about their ability to stay up to date and balance issues of privacy and safety.

PST's responses to the interview about their levels of comfort with DL indicated that they are not confident about their abilities, which aligns with previous studies (e.g. Žolgar & Lipec Stopar, 2016; Peled, 2021). Their discomfort may stem from their lack of experience and preparedness in utilizing digital tools effectively (Graziano, 2018; Hojeij, 2023). The lack of confidence and feelings of being underprepared among PSTs could create challenges for both teachers and students (Yada et al., 2021). In addition, teachers' perceptions of their technology skills have a direct and positive impact on their beliefs regarding usefulness (Dogan et al., 2021).

Therefore, PSTs need to receive training that will equip them to instruct students utilizing DL. In other words, practical experiences are important for fulfilling the course and major requirements and valuable for building the future in the student's field and knowledge of selves as professionals.

Future research

Although this study found themes concerning DL, additional areas for research are apparent. While the study described is qualitative in scope, large-scale studies of pre-service and in-service teachers in DL are also required to present a broader picture of their experiences. Future research should examine PSTs' skills in working with digital tools and examine different technology-related courses' productivity as well as investigation of how effectively teachers teach and utilize DL within their own classrooms and how their attitudes change once in the classroom.

Limitations

The small sample size leads to limitations. While many of the findings from this study mirror earlier research, these findings cannot be generalized to all PSTs. In addition to the limitation presented by the small number of volunteers, the responses were based on one technology-related course at a single university and are, thus, highly contextualized.

Recommendation

Universities and policymakers should consider ways of effectively engaging PSTs in developing their own understanding of and confidence in utilizing DL. This will likely be an ongoing process in which continual curriculum development will be needed as technology changes and new DLs are available. Responses from study participants remind the university to

think more about courses related to developing DL. Subsequently, they must focus on DL more than is currently evident. The contributions from participants indicate they would benefit from additional supports to build their confidence in DL skills, such as additional courses or a series of workshops which support PSTs confidence in their abilities to collect information, evaluate this information and use it effectively and ethically within their own studies and in their future classrooms.

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