

Exploration of a Digital Technology Adoption among Indigenous People in Guyana

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ABSTRACT

Training is a vital in crystallizing acceptable technological classroom practices. The purpose of this basic qualitative study was to discover the perceptions of Indigenous Amerindian preservice teachers about the adoption of digital technology in the classroom. Rogers's diffusion of innovation theory and David and Venkatesh technology of acceptance model served as theoretical precepts to understand indigenous Amerindian preservice teachers' perceptions about the use of digital technology, perceived barriers, and the coping and adopting mechanism throughout their pedagogical practices. Ten indigenous Amerindian preservice teachers participated in this qualitative study. Semistructured, interviews were the primary data collection tool. Open coding was used to generate themes, and analyzed emergent coding. The findings of this study indicated that the rate of adoption of digital technology could accelerate if (a) training is strategic, (b) reduction of institutional barriers, and (c) professional practices are aligned for educational growth. Indigenous Amerindian preservice teachers may be served well to acquire the skills and overcome the technological barriers to better prepare learners beyond the classroom. Even though internet access would facilitate indigenous Amerindians in Guyana to develop technology literacy skills and access educational resources, some preservice teachers have a low rate of technology adoption in the classroom. This study may contribute to knowledge to the field of digital technology and furthers understanding of pedagogical practices. The findings may also contribute to positive social change in that professional development centers can improve skills that provide flexible learning for IAPT to integrate digital technology beyond the classroom. and serve as a catalyst to promote growth by capacity building.

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Introduction, Background and Rationale for the Study

A growing concern is cited by many in contemporary societies about the limited understanding of the intricacies in the uptake of knowledge and learning among ethnic groups within the formal and traditional classroom structure (Ankiah-Gangadeen, & Nadal, 2018). The knowledge deficit prompted this study, as the aim was exploring the challenge on how to educate these groups in keeping with current learning standards. A similar concern exists in Guyana, among the Indigenous population (Menezes, 2017). Indigenous peoples in Guyana are descendants of recognized as the first inhabitants who occupied the country before the arrival of the Europeans (Menezes, 2017). They are referred to as the Amerindians and have their settlements in Guyana's most remote and interior areas. Despite this reality, Indigenous Amerindian preservice teachers are expected to be exposed to similar services, and use the same tools, like those used by other teachers who live in close proximity to Georgetown, the capital city of Guyana. In addition, educational outcomes of Indigenous Amerindian learners are expected to be on par, and the same with those of the other learners throughout the country.

To enable the realization of these expectations, special provisions were made by the government, in light of the frequent cries of marginalization, especially in the field of education (Granger, 2016; Ramsey & Deana, 2018). Indigenous Amerindian preservice teachers at the Professional Development Center originated from various Amerindian settlements and communities and are exposed to the same degree of digital technology as those from the capital city and the coastal areas in Guyana. There were possibly also underlying perceptions within the education fraternity that teachers needed to master skills that would provide learners in indigenous communities with authentic experiences to adopt digital technologies (Chance et al., 2019; Nasruddin, 2018).

Technology Integration and Adoption Challenges

The integration of digital technology has become an essential ingredient for the delivery of education in developing countries (Jawarneh, 2017). Since digital technology is changing globally, the need for the training institution to create a more robust training plan for Indigenous Amerindian preservice teachers to integrate digital technology into their pedagogical discourse is an ongoing quest and a desired outcome (Jeffery, 2019; van Tassel-Baska & Hubbard, 2016; Yeh & Wan, 2019). Bates (2017) noted, that it is imperative that teachers training

institutions act expeditiously to provide adequate technological learning experiences for Indigenous teachers to enhance and realize success in a rapidly changing contemporary classroom environment.

The role of a preservice teacher is to guide students to become critical thinkers and problem-solvers in the current and contemporary environment and contemporary classroom (Castagno et al., 2016; Sellars, et al., 2018). All teachers are required to learn how to use digital technology in schools, yet training are inadequate in schools in remote areas (Tyler-Wood et al., 2018). Indigenous educators in hinterland, rural, and remote communities were way behind counterparts in terms of technology, yet, were required to use skills in digital technology to move the learners along the study continuum. Policymakers and administrators often lack the skills necessary for systematic change and technological integration into long-term reorganization procedures of a teaching program (Neiterman & Zaza, 2019; Pincus et al., 2017; Townsend et al., 2017). It is further stated that technological integration was met when the teaching environment utilized tools to encourage new methodologies and strategies for teachers to deliver the curriculum (Ossiannilsson, 2018; UNESCO, 2018). Therefore, effective integration of digital technology by Indigenous Amerindian preservice teachers may be hindered by teachers' perceptions, particularly if the populations were less likely to have access to the technologies (Litz & Scott, 2017; Parkman et al., 2018).

Education is a vital component for crystallizing acceptable technological classroom practices. Still, Indigenous Amerindian preservice teachers needed to first acquire the skills and overcome the technological barriers to better prepare learners. The International Society for Technology in Education (ISTE) and UNESCO has recommended appropriate technological standards for teachers, students, and administrators. Guyana's present educational climate had set standards for technology integration. There was no doubt that digital technology was used extensively at the training institution for training and learning. UNESCO's ICT competency framework supported the enhancement of preservice teachers' and students' skills as aligned with teacher education at the training institution (UNESCO, 2018). In support of the framework competencies, there was a need to continuously train Indigenous Amerindian preservice teachers to be more grounded in the integration process of digital technology within their classroom.

Continuous Learning and Ongoing Improvement

Arguably, training without follow-up for Indigenous Amerindian teachers will reduce digital technology adoption in the classroom (Townsend et al., 2017). Hence, it only fits Indigenous Amerindian educators to be equipped with the resources needed to integrate technology in a contemporary classroom. Several studies have also indicated the need for policymakers to sustain the implementation of technological training for all educators beyond college (Haynes & Shelton, 2018; Showalter et al., 2019). If Indigenous Amerindian preservice teachers had continued to use the first teaching method, then the adoption of digital technology would not become a reality (Geng et al., 2019; Lamb & Weiner, 2018). Indigenous Amerindian preservice teachers were needed to be exposed to technological skills to advance pedagogical tools that would have also likely enhanced the curriculum's delivery. With the rapid evolution of digital technologies, administrators and policymakers understand the need for Indigenous Amerindian preservice teachers to use digital

technology in their classrooms. These needs must be addressed to enable Indigenous Amerindian teachers to become adopters of digital technology, and thereby leverage technology effectively, to enhance learning and knowledge acquisition by students in the classroom.

Spiteri and Rundgren (2020) suggested, that there are many strategies that will allow Indigenous teachers to use digital technology to assist students in achieving their full potential. It has been further shown that preservice teachers use digital technology while in training in many schools; however, it has been noted that teachers generally lack follow-up support after training. The emphasis of continuous learning and ongoing improvement is evident however to some extent, however much remains to be accomplished.

Problem identification from Exploratory Analysis

The problem studied, upon identification in qualitative study was the low adoption rate of digital technology in the classroom by Indigenous Amerindian preservice teachers. From the extensive research and background information perused and analyzed, it was noted, that even though the internet access would allow Indigenous Amerindian in Guyana to develop technology literacy skills and access educational resources, Indigenous preservice teachers have a low rate of technology adoption in the classroom, according to the Guyana National Development Strategy (NDS, 2017). In view of these deficiencies, consequently, Indigenous Amerindian preservice teachers had to undergo intensive training to acquire knowledge to become competent in instructional technology. It was further posited that intensive training could boost the confidence of Amerindian teachers when teaching Amerindian students on how to use digital technology (Min et al., 2019; Tyler-Wood, 2018). These reasons prompted this study, and hence, there was a need to understand Indigenous Amerindian preservice teachers' perceptions about the use of digital technology by undertaking this research study.

The Professional Development Center in Guyana was the ideal setting to conduct and study this issue. As the setting of this study was the principle Professional Development Center, this institution was tasked with the role to effectively prepare Indigenous Amerindian preservice teachers with appropriate teaching methodologies so that they could function in the classroom. Although there are growing bodies of research on digital technology in preservice teachers' education programs in developed and developing countries (Jita, 2018; Sauers & McLeod, 2017), there is seemingly, an apparent gap in literature relating to Indigenous Amerindian preservice teachers' acceptance-in implementing digital technology at their indigenous location. The knowledge deficit stems from not much being known about Indigenous Amerindian preservice teachers' perceptions and digital technology adoption. Without the diffusion of technology in the schools, Amerindian students who lack access to digital technology would have the least opportunity to adapt to technological principles. While the use of digital technology is dynamically changing the structure of teaching, there is a gap in the literature concerning the perceptions and attitudes of Indigenous Amerindian preservice teachers and their plan to incorporate digital strategies in the classrooms of schools serving Indigenous students. The outcome of this study may provide knowledge and appropriate support, that may have potential to influence positive social change for policymakers and stakeholders in Guyana toward the integration of a digital technological program.

Overarching and Supplementary Research Questions

The overarching research question for this study and the supporting questions for this study are as follows: What are Indigenous Amerindian preservice teachers' perceptions about using digital technology in the classroom?

Supporting Questions:

RQ#1-What are Indigenous Amerindian preservice teachers' perceptions of the adoption of digital technology in their daily pedagogical practices?

Theoretical and Conceptual Underpinning of the Study

The focus of this study was to discover the perceptions of Indigenous Amerindian preservice teachers' towards the low adoption of digital technology at the Professional Development Center in Guyana. Rogers' diffusion of innovations theory (DOI) and the technology acceptance model (TAM) served as a lens, to ground the study and aided in understanding the digital technology's adoption process among Indigenous Amerindian preservice teachers. The theory and model provided a structure to support individual adopters within a specific group. Rogers (2004) proposed a categorization system for adopters.

Scope and Delimitations

The scope of the study was limited to the Indigenous Amerindian preservice teachers from the Professional Development Center in Guyana and did not include administration, lecturers, or board trustees at the institution. The exclusions of personnel were because they did not instruct preservice teachers on how to integrate digital technology into the classroom. Preservice teachers are practitioners and were supposed to be at the helm of integrating digital technology into their pedagogical practices. Additionally, the scope of this study did not extend to include the University, the Institute of Distance Education and Learning, the Government Technical Institute, or K-12 grade teachers.

Random sampling was employed to draw and select participants from the population. The sampling approach facilitated division of the large population of the Professional Development Center Indigenous Amerindian preservice teachers into distinct strata since it is a fair way of selecting a population sample. Hence, every member was given an equal opportunity of being selected in the sample. A combination of ten Indigenous Amerindian preservice teachers were selected from the Associate Degree program in Technical Teacher Education and Degree in Education inclusive of Early Childhood Education, Primary and Secondary Education. These were representative of the Professional Development Center's Indigenous Amerindian population.

Critical Review of Literature

In the contemporary classroom, digital technology is rapidly changing the pedagogical process and modernizing schools in developing countries. It is therefore becoming increasingly important for Indigenous Amerindian preservice teachers to demonstrate their full potential in a dynamic environment.

Appreciating the impact of digital technology on everyday life, the Professional Development Center is trying to restructure their curricula in order to bring Indigenous Amerindian preservice teachers into a technological learning arena. The restructuring process requires the effective integration of digital technology to capture and sustain learners for maximum professional productivity. The integration of digital technology at the Professional Development Center therefore needs a holistic approach for

Indigenous Amerindian preservice teachers to established their technology adoption framework that fits into Guyana's educational goals (Department of Public Information, Guyana, 2019; Lovett, 2017).

Research Choices in Methods and Design Selection

The purpose of this qualitative study was to discover the perceptions of Indigenous Amerindian preservice teachers about digital technology integration in the classroom. Studies of Indigenous peoples' ability to access digital technology (Starkey, 2020; Prayaga et al., 2017) to utilize technological strategies and maintain their identity (Norton, 2019; Walid et al., 2017), revealed, a range of barriers that affected the acceptance of digital technologies as instructional tools. Based on previous research (Norton, 2019), the question of how Indigenous Amerindian teachers use digital technology for instruction has been answered. There is a gap in the literature about Indigenous Amerindian preservice teachers' perceptions of digital technology as an instructional tool in Guyana.

Porter (2017) noted that innovation facilitates a well-planned process for Indigenous educators to balance the changes introduced by technologies into their communities. With integrating digital technologies into the curriculum, Indigenous teachers will expose educational opportunities that support their identity. For Indigenous Amerindian preservice teachers to accept digital technologies, long-term planning should be linked with strong traditional values (Kuru Gönen, 2019).

Since an understanding was being sought of Indigenous Amerindian preservice teachers' perceptions of digital technology, a qualitative methodology, using interviews was used to undertake this study. The invocation of a qualitative method helped the researcher to be more intimate with participants to collect data, understand participants' experiences through their lenses, provide a comprehensive and detailed summary of the data with practical terms, and describe the experiences of participants with their words (Alvesson & Sköldbberg, 2017; Ames et al., 2019; Brandt et al., 2018). Thus, the interview approach typically served to deepen understanding of the subject where participants re-encounter their personal experiences with the realities of being an Indigenous Amerindian preservice teacher at the Professional Development Center. During the interview process, the recorded experiences of participants highlighted their personal perceptions.

Data Collection Approach

To undertake this qualitative research study, only one source was utilized for the data collection. Ten Indigenous Amerindian preservice teachers participated in one round of semi structured face -to- face interviews, conducted at the Professional Development Center. The resulting data were transcribed and coded using inductive methods (Strauss & Corbin, 1998), Rogers (2004) DOI, and Davis's (1986) TAM four emergent themes were developed: (a) benefits, (b) barriers, (c) influence on adoption, and (d) implications. The technology acceptance model, was used to develop two emergent themes: (a) perceptions, and (b) use of technology.

Interviews

I contacted the Chief Education Officer of the Ministry of Education (Guyana) for his permission to access the Teacher Professional Development Center. The Institution's Principal fully cooperated by allowing to conduct the face-to-face interview sessions after selecting the potential participants, based on the inclusion criteria. The recruitment

of participants took place between the latter part of January, 2020 and the middle of February 2020. All interviews were audio-recorded using transcription software on a Samsung smartphone and a laptop computer. An individual voice template was used to record the interview, which was labeled with the emergent pseudonym generated for this study (which are IAPT 1-10 for Indigenous Amerindian preservice teachers). The audio recordings were downloaded from the smartphone to transcriptions software. These were saved to a secure, encrypted, and password-protected external hard drive and a google cloud account and then deleted from the smartphone device. All interviews at the institution were conducted in the space of the participant's choice after 3:00 pm UTC-4, as shown in Table 3.

After the completion of the interviews, the data were prepared and analyzed. First, the smartphone was used to make written transcriptions from the audio recording. The transcription was reviewed for accuracy by comparing the audio to the written transcripts. The text was updated due to inaccuracies, added punctuation, and masked information revealing the institution's name. Transcripts were sent to participants for them to review the same for accuracy. Next, the Word documents were uploaded to NVivo, and subsequently each document was coded by hand. Lettered pseudonyms were assigned to protect for each participant.

Data Analysis

For this basic qualitative study, I conducted data analysis using three steps. I used inductive analysis, which Dreamson et al., 2016 recommended for qualitative research. To help in this process, I have developed categories into a model using Rogers (Rogers, 1995) diffusion of innovation theory and the second using Venkatesh and Davis (2000) Technology of acceptance model. I focused on identifying emergent patterns to determine the emergent themes, as highlighted by Saldaña (2013).

Data Analysis

For the initial step, of the data analysis, I adopted the strategy of inductive analysis and then uploaded all transcripts to NVivo. I used the framework of the DOI and the TAM. This strategy has five steps: initial reading of transcripts, identification of specific text segments related to the objectives, labeling the segments of the text to create categories, reducing overlap and redundancy among the categories, creating a model to incorporate most important categories as suggested by Merriam and Tisdell (2016). Subthemes were identified after several times of reading each transcript.

As I continued to read each transcript, I checked my codebook to ensure that I had assigned the proper emergent themes to the text excerpts. Then I adjusted the codebook as

needed when I gained clarity about the particular code Appendix A. I considered possible meanings that fitted into emergent themes. The transcripts were read horizontally, and segments of text were grouped. Themes were named in three ways: words from participants, literature concepts, and the framework. Based on the emergent themes, each interview question (IQ) was placed in the category (1: Benefits, 2: Barriers, 3: Influence on Adoption, 4: implementation). I used NVivo to complete the initial coding. The emergent themes text was assigned to free nodes in a disordered arrangement.

After the process was concluded, I stripped and reunited the emergent themes using xMind mapping software that aided in the visualization of data and yielded additional patterns and meaning in the data. The emergent codes that emerged from the data aligned with the study's conceptual framework and research questions. I grouped these themes to identify emergent emergent themes and aligned with the overarching RQ as shown in Figure 1.

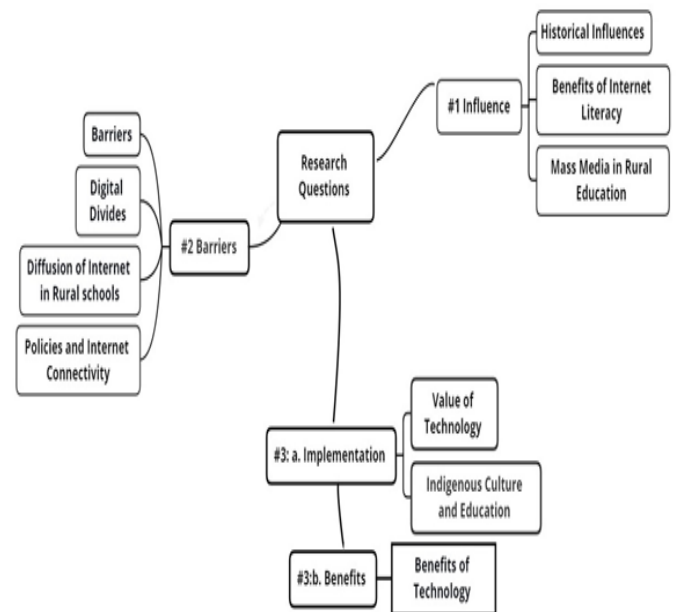


Figure 1. Emergent Codes Aligned to Research Question 1

Note: This figure demonstrates the alignment of literature review and RQL What are Indigenous Amerindians preservice teacher perceptions of the adoption of digital technology in their daily pedagogical practices?

Although the themes that emerged aligned with the conceptual framework, the flexible approach to analysis that I took allowed me to recognize that others more strongly emphasized some scopes of the participants. I designed a table using Microsoft Excel, where I grouped the interview questions by relevance to each of the three research questions.

Table 1. Emergent Themes and Categories for the Adoption of Digital Technology

Benefits	Barriers	Influence on adoption	Implementation
Digital technology supports the planning of lessons	No technical support is a barrier Lack of communication and sharing of information	Peers are more knowledgeable	Indigenous Amerindian preservice teachers should be asked for input into the execution of curriculum while training.
Provides access to online resources and research materials for individual studies	Limited internet access No previous knowledge in the area of digital technology	Digital technology especially the smart phones are used more in personal activities.	A one size fit all approach would not work for the teachers. Continuous professional development for the Indigenous Amerindian teachers
Digital technology motivates learners	Some administrators and lecturers are blunt to assist with initial use of digital technology		
Helps in creating worksheets Digital technology creates alternative in class activities	Time spent to complete document on computer, Frequent power outage Intimidated if system is damaged		

Note: This table demonstrates the alignment of emergent themes to research questions. Overlapped themes are grouped under the heading: benefits, barriers, influences on adoption and implementation

The text of each participant's responses was color-coded line by line and grouped under each interview question, as I carefully listened to the recording. I highlighted the provisional emergent themes line by line or by long phrases, numbered the frequencies of words as I transcribed the interviews. The categorizing process was repeated in Microsoft Excel and transferred into (NVivo version 12) and into xMind. In Microsoft excel, I followed along on the excel document of the transcripts line by line, typed an emergent theme when possible, and generated provisional coding if a priori emergent themes did not accurately capture the responses.

The participants provided their descriptive responses to the questions during the face-to-face interviews. After the interviews, I placed my research questions, framework, and the purpose of my study to satisfy the coding process. They were placed in front of me while I scrutinized each manuscript for themes. A professional transcriber 'dragon anywhere', subsequently transcribed the audio-recorded responses into Word documents, and the coding continued.

The participants discussed their influence, barriers, benefits and implementation, and ways they can adopt digital technology. While the purpose of this study is to discover the perceptions of the teachers about the integration of digital technology, the re-emergence of barriers such as communication at the institution did present obstructions at the beginning of the data collection process. Those barriers were overcome before the conclusion of the data collection process.

The emergent pattern occurred within 25.0% (13/52), of the text segments, shared during IQ 9: "what skills and knowledge do you lack that might be affecting your use of digital technology?" One hundred percent of the participants shared that the necessary skills and knowledge were lacking. When asked to speak about the skills and knowledge needed, IAPT 1 shared, "skills! -technology skills are alien to me; I have none, no not one, neither knowledge period -I mean none whatsoever about the use of digital technology". In addition, to the teacher's exclamation about the absence of technological skills, the teacher shared credible ways to integrate new teaching tools to understand the appropriate techniques and steps associated with the process of using technology. All Indigenous Amerindian preservice teachers commented on the classrooms' structural design, which calls for multiple skills such as "turning on and off of devices, understanding the keys on the system, connecting a projector,

exploring Microsoft and finding valuable information on line." IAPT 2, online, described their exposure to using digital technology. IAPT 2 said, "I wish if more time was allotted to us." IAPT 3 shared, "it is funny how trial and error applied at the institution.

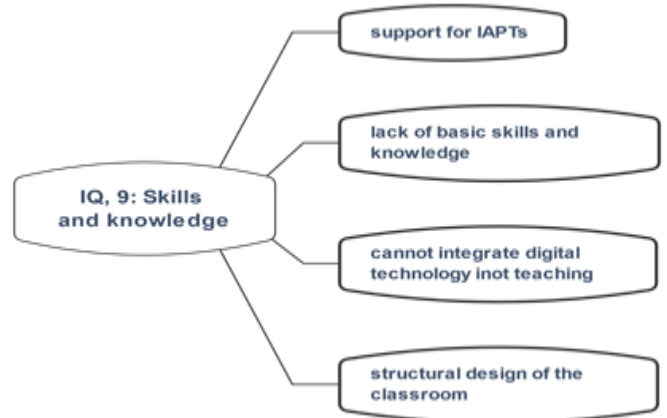


Figure 2. Emergent Code and Sub Codes Aligned to RQ 1 and IQ 9.

Note: The figure demonstrates the skills and knowledge of IAPT's connected to RQ 1- What are Indigenous Amerindian preservice teachers' perceptions adoption of digital technology in their daily pedagogical practices?

Additionally, IAPT 2 and 5 shared, "knowing the device is good, but how to integrate it into the lessons is another thing." For instance, explains IAPT 9, making and downloading of videos as a teaching tool is far from reality. She shared that her phone is being used to receive and send calls, but not to make any videos. Similarly, IAPT 2 shared how dumb it feels, "that shucks man." I feel like a modern-day prisoner with no skill to compete in this technological saga. IAPT 10 said, "I honestly, based on the exposure given to preservice teachers, I have no patience to learn technological skills; IAPT 5 agreed with the view.

Similarly, IAPT 6 shared that lack of knowledge surrounding technology use to enhance their creativity, collaborating with other educators, and motivating learners to connect with their counterparts is grossly lacking. IAPT 6 indicated that the lack of knowledge about the use of Google apps, Microsoft tools, or any other technology that may help organize and keep learners on track is evident. IAPT 6 also recalled that they were never exposed to acquiring the knowledge and skills of readiness to merge existing content,

Table 2. Research Question 1 with Emergent Themes and Subthemes.

Approach of lecturers	Perceptions	Skills and knowledge	Adopters of digital technology
Collaboration: - Student - instructions - professional growth	Lack of Knowledge: - readiness - shared experiences - remote communities: i. accessibility ii. support iii. multi-grade teaching	Resources: - finance - computer - smartphone	Enhanced teaching: - support - networking
Curriculum delivery: - instructional tools - observational skills	Pedagogical organization - merging existing content - provide rich information	Techniques: - manage technology tools - installation of devices	Teaching tool: - software - hardware
New strategies: - technology - integrated approach - student centered		Technological skills: - typing - research - assorting materials	Multiple skills: - downloading of materials - creating video with local content
		Motivated: - language - demographic	

Note: RQ 1:What are Indigenous Amerindians preservice teachers' perceptions of the adoption of digital technology in their daily pedagogical practices?. The analysis of research question one

connecting them to other subjects with rich information, and maintaining the structure; hence it is lacking.

Recommendations

Recommendations for further research are based on study results and limitations of the study. As this study was one of the first to examine Indigenous Amerindian preservice teachers' perceptions about the integration of digital technology, I recommend that additional studies with Indigenous Amerindian preservice teachers are conducted to confirm and/or disconfirm the findings. In addition to further exploring Indigenous Amerindian preservice teachers' viewpoints, I recommend that studies on this topic be conducted with Indigenous Amerindian inservice teachers to gather viewpoints on the adoption of digital technology beyond the classroom. Therefore, more research is needed to be conducted for the low adoption of digital technology, and to build a deeper understanding of Indigenous Amerindian preservice teachers' perceptions about the adoption of digital technology for pedagogical growth and professionalism within the education system.

Conclusion

The problem related to this study was that the low adoption of digital technology in the pedagogical practice among Indigenous Amerindian preservice teachers was not understood. In this basic qualitative study, a variety of factors and interventions were explored to obtain a deeper understanding of the complex process of preparing Indigenous Amerindian preservice teachers increasing the rate of adoption of digital technology in the field of teacher training. The results of data collected for this study yielded 17 themes. Ten of which explicitly related to the preparation of Indigenous Amerindian preservice teachers and five related to the conditions necessary to impact the adoption rate of digital technology at the (training) institutional, individual and societal level. The key finding for this basic qualitative study was that Indigenous Amerindian preservice teachers could be budding adopters of the educational transformation that is needed to fully integrate digital technology into pedagogical practices and beyond the classrooms.

As Scherer et al. (2018) indicated, it is essential that preservice teachers be trained to acquire 21st-century skills and strategies for integrating digital technology. This study has supported the theory that digital technology can no longer be simply viewed as a personal communication tool, or browsing the web, but must be viewed as useful for Indigenous Amerindian preservice teachers to attain professional guidance and support for integrating instructional tools and strategies for meaningful training practices, of closing the educational gap. Evidence further revealed that the intensive training, which was posited as a boost to teachers' confidence when teaching preservice Indigenous Amerindian learners, provided a platform for positive social change from which policymakers and stakeholders can formulate a much-needed plan of integration. Hence, the growing concern surrounding learning among Indigenous populations which existed as the conception of the study and which in fact still exist today in Guyana, is a very fertile ground for the exploration to conduct similar justifiable endeavors in the field of educational research.

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