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Barriers to Internet Access and Adoption, and Strategies for Promoting Digital Skills among University Students in Puerto Rico

Barreras al acceso y adopción de internet y estrategias para promover las competencias digitales en estudiantes universitarios de Puerto Rico

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ABSTRACT

The study's research problem is to assess digital inequities among university students and to explore how digital skills education can improve university-level education. The study objectives address three topics: 1) identify the barriers low-income college students face in accessing and adopting broadband internet services, 2) assess if digital skills education improves the adoption of broadband internet services, and 3) identify relevant teaching strategies to improve access to and adoption of internet services and digital skills education among university students, which could be valuable for government agencies and higher education organizations in Puerto Rico. Based on empirical findings, it explored the role of education in developing the digital skills needed to utilize the Internet effectively in these subjects. The study employed a mixed-methods approach with a sequential design. In the quantitative phase, an entry questionnaire was administered to a sample of fifty ($n = 50$) students. Subsequently, a workshop on digital skills was offered to the participants, followed by an exit questionnaire. In the qualitative phase, a focus group was conducted with six (6) students who had participated in the quantitative phase. The results revealed a low prevalence of barriers to Internet use and access among the sample subjects. They consistently connected to the Internet via their mobile phones, at home, and within the university context. There was a high demand for learning digital applications, such as CapCut and Canva, as well as information about artificial intelligence and cybersecurity. Participants reported an increased perception of knowledge regarding concepts such as the digital divide, digital equity, and the digital skills emphasized in the workshop. This increase was statistically significant ($p < 0.05$).

RESUMEN

El problema de la investigación son las desigualdades digitales entre los estudiantes universitarios y explorar cómo la educación en destrezas digitales puede mejorar la educación a nivel universitario. Los objetivos del estudio abordan tres tópicos: 1) identificar las barreras que enfrentan los estudiantes universitarios de bajos recursos para acceder y adoptar servicios de internet de banda ancha, 2) evaluar si la educación en habilidades digitales mejora la adopción de servicios de internet de banda ancha, y 3) identificar estrategias de enseñanza relevantes para mejorar el acceso y la adopción de servicios de internet entre los estudiantes universitarios, lo cual podría ser valioso para las agencias gubernamentales y las organizaciones de educación superior en Puerto Rico. Con base en hallazgos empíricos, se exploró el papel de la educación en el desarrollo de las habilidades digitales necesarias para que los sujetos utilicen la Internet de manera efectiva. El estudio empleó un enfoque de métodos mixtos con un diseño secuencial. En la fase cuantitativa, se administró un cuestionario de entrada a una muestra de cincuenta ($N=50$) estudiantes. Posteriormente, se ofreció a los participantes un taller sobre destrezas digitales, seguido de un cuestionario de salida. En la fase cualitativa, se realizó un grupo focal con seis (6) estudiantes que habían participado en la fase cuantitativa. Los resultados revelaron una baja prevalencia de barreras para el uso y acceso a internet entre los sujetos de la muestra. Se conectaron a la Internet consistentemente a través de sus teléfonos móviles, en casa y en el contexto universitario. Hubo una alta demanda de aprendizaje por las aplicaciones digitales CapCut, Canva, y los temas de inteligencia artificial y ciberseguridad. Los participantes reportaron un aumento en la percepción de conocimiento sobre conceptos como la brecha digital, la equidad digital y las habilidades digitales enfatizadas en el taller. Este aumento fue estadísticamente significativo ($p < 0.05$).

KEYWORDS | PALABRAS CLAVE

Digital Equity, Digital Skills, Digital Inclusion, Digital Divide, Internet, Puerto Rico.
Equidad digital, destrezas digitales, inclusión digital, brecha digital, Internet, Puerto Rico.

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1. Introduction

Citizens' access to and adoption of online spaces through the Internet and digital applications on smartphones enhance their agency to engage in academic, economic, political, cultural, and social activities. These activities foster the development of "digital citizenship". Digital citizenship refers to individuals' ability to participate in online environments in a daily fashion using the Internet and other information and communication technologies (ICTs) "for political information to fulfill their civic duty and who utilize technology at work for economic benefit" (Mossberger, Tolbert, & McNeal, 2008, p. 2). Digital citizenship is part of a comprehensive conceptual framework that encompasses the digital divide, digital inclusion, digital skills, and digital equity in the development assessment of the information society (Castells, 2001; Gorsky, 2005; Gurstein, 2007; Hagirttai, 2002; Morduchowicz, 2020; Warschauer, 2003).

Access to the Internet is ubiquitous in modern societies, but its access and adoption by citizenry is uneven due to socioeconomic inequities in offline environments (Hargittai, 2002; Van Deursen et al., 2017; Van Dijk, 2005). The social divide is understood as structural political, economic, and social inequities in society that span over time and across different social groups. For instance, Gorski (2005) framed the digital divide within larger economic, educational, and social inequities, including racism, sexism, classism, linguistics, and ableism. Also, Warschauer (2003) examined the intersection of ICTs and social inclusion. According to this author, ICTs should serve as instruments for social, educational, and economic development. To be effective, ICTs must facilitate access to and adoption of technologies, consider the content and language of digital products, address the literacy and education of citizens, and align with the objectives and practices of institutions and organizations to promote social inclusion. Warschauer (2003) argues, "From a policy standpoint, the goal of using ICT with marginalized groups is not to overcome a digital divide but rather to further a process of social inclusion" (p. 47). The involvement of individuals and communities in online spaces through ICTs energizes social progress and contributes to the economic, political, and cultural well-being of citizens and vulnerable groups.

Digital divide and digital inclusion initiatives take place in multiple and diverse contexts (i.e., settings). The study objectives address three topics: 1) identify the barriers low-income college students face in accessing and adopting broadband internet services, 2) assess if digital skills education improves the adoption of broadband internet services, and 3) identify relevant teaching strategies to improve access to and adoption of internet services and digital skills education among university students, which could be valuable for government agencies and higher education organizations in Puerto Rico. Additionally, based on empirical findings, it explored the role of the "University Context" and its benefits in developing the digital skills needed to utilize the Internet effectively in these subjects.

In the United States, over the last decade, alongside the development of broadband internet for homes, a significant rise in wireless telephony and mobile internet has been noted as a mode of internet access Mossberger, Tolbert, & Hamilton, 2012; National Telecommunications and Information Administration [NTIA], 2014). Specifically, economically disadvantaged groups who lack internet access at home and rely on mobile telephony (smartphone-dependent users) for their internet access and usage have favored the offerings of mobile phone companies, including products (e.g., smartphones, tablets) and services (e.g., data plans) (Gallardo & Geideman, 2019; McCabe, 2013; Mossberger, Tolbert, & Anderson, 2016; Napoli & Obar, 2013). In 2023, Puerto Rico's estimated population was 3,205,691 residents, with an average age of 45 (US Census, 2023 ACS, Table S0101).

Like the United States, Puerto Rico has experienced an upward trend in mobile telephony and mobile internet usage over the past two decades (Rosario-Albert, 2016). For instance, the total number of telephone lines (4,727,840) in Puerto Rico, which includes wired, wireless, and Voice over Internet Protocol (VoIP), evolved from 3,208,824 in 2014 to 3,958,779 in August 2024. This shows an increase of 749,955 wireless lines, accounting for a growth of 23.4% (Negociado de Telecomunicaciones de Puerto Rico, 2024, pp. 2-3). From 2020 (3,495,590) to August 2024 (4,329,710), there has been a consistent upward trend in wireless phone lines yearly.

In Puerto Rico, mobile telephony services are usually offered alongside data plans for mobile internet access. These figures suggest a correlation between the demand for mobile phones and mobile internet usage. An indicator of the growth of mobile telephony as a means of internet access in Puerto Rico is the total number of internet service subscribers. Between 2014 (2,774,667) and August 2024 (4,329,710), there was a 56% increase (1,555,043) in internet subscribers (NTPR, 2024, p. 5). By then, the NTPR (2024, p. 6) categorized mobile subscribers with data plans into four groups based on upload and download speeds:

1) Less than 5 Mbps - 47% (2,044,426), 2) 5 Mbps to less than 100 Mbps – 38% (1,651,067), 3) More than 100 Mbps – 15% (622,374), and 4) Less than 1 Mbps – 0% (11,843). This data shows that most users were in categories 1 and 2, making up 85% of mobile internet users. In March 2024, the Federal Communications Commission (FCC) defined a broadband internet connection as one with a minimum download speed of 100 Mbps and an upload speed of 20 Mbps (Taglang, 2024). In this context, despite the increase in mobile telephony and mobile internet access, the number of subscribers with broadband internet service (i.e., high-speed internet) accounted for only 15% of total subscribers by August 2024.

2. Literature Review

This section discusses the conceptual framework to assess digital divide, digital inclusion, and digital skills education in the university context.

The digital divide, digital inclusion, and digital skills encompass a broadened and multidimensional conceptual framework (Hargittai, 2002; van Deursen & Helsper, 2015). Based on empirical approaches, authors have addressed digital exclusion across socio-economic and socio-technical variables, such as contexts (Gurstein, 2007), gender (Hargittai, 2002; Prendes-Espinosa, García-Tudela, & Solano-Fernández, 2020), income (DiMaggio et al., 2004), age (Hargittai, 2002; Hargittai, Füchslin, & Schäfer, 2018; Hargittai & Hinnant, 2008), race/ethnicity (Gorski, 2005; Warschauer & Matuchniak, 2010), education (Van Deursen et al., 2017); and computational devices, such as smartphones (Gallardo & Geideman, 2019; Mossberger et al., 2016; Napoli & Obar, 2013). Also, as van Deursen and Helsper (2015) state, the term digital divide has evolved to a multiple-level classification: 1) first-level divides are related to access and affordability to telecommunication services and products; 2) second-level divide focus on digital skills and usage patterns, and 3) third-level divide aims at a "deeper understanding of the mechanisms translating internet use into specific offline outcomes (e.g., Stern, Adams, & Elsasser, 2009)". (p. 31).

In opposition to digital divides, digital inclusion public policies and initiatives encompass two key aspects: 1) affordability to telecommunications services and computational products, and 2) knowledge of the digital skills necessary to utilize ICTs to participate in online environments effectively (Alonso-Hernandez et al., 2024; Hargittai, 2002; Reisdorf & Rhinesmith, 2020). The scholarship has highlighted that digital inclusion strategies should enable access to online environments regardless of socioeconomic factors, allowing individuals and communities to benefit from the digital economy and participate in the political arena (Méndez-Domínguez et al., 2023). Also, Alonso-Hernandez et al. (2024) studied the determinants of digital inclusion. They found that proactive public policies and inclusive digital skills education are determinants to "promote effective digital inclusion, ensuring equitable participation in the information society and contributing to socioeconomic development". (p. 43).

Citizen access to the Internet and digital skills education is asymmetrical, given the various contexts (i.e., settings), such as households, workplaces, schools, universities, libraries, community centers, and recreational spaces. In this study, the university context serves as the backdrop for assessing digital inequities and digital skills education among university students. Higher education institutions have undergone digital transformations to accelerate digital inclusion and digital skills education (Drljićet al., 2025; Naranjo Crespo & Carrasco Temiño, 2022; Redda, 2024). During the COVID-19 pandemic, higher education institutions accelerated and expanded their digital transformation (DT) efforts. For instance, according to Redda (2024), South African universities already adopted digital technologies for teaching, learning, and assessment activities. However, the COVID-19 pandemic played an instrumental role in accelerating the digital transformation.

In Puerto Rico, the university context was strengthened by various grants from the Federal Government, which facilitated programs for distributing laptops to low-income students and making capital improvements to technological infrastructure for remote teaching access. In this regard, the university setting mitigates the technological, social, and educational barriers associated with the digital divide, serving as a singular environment for accessing the Internet and developing digital skills. Warschauer (2003, p. 76) described universities as public access centers for the Internet. The interaction modalities with ICTs include free internet access, computer resources (i.e., computers), digital information resources (e.g., electronic libraries), technical support services, and face-to-face and remote education. Furthermore, U.S. universities have collaborated with external groups to develop public Internet access centers (Koenig, 2022). Based on the above, the university context is an organized space with various modalities of internet access and an educational offering that incorporates

digital skills education and furthers digital citizenship (García-Martínez et al., 2020).

Regarding young people's interaction with the Internet and ICTs in the digital age, Prensky (2001) coined the term "digital natives" to identify generational groups that engage with technology differently than previous generations. In the university context, this category facilitates exploring internet access modalities and instructional strategies for digital skills education. Various social stakeholders have emphasized digital skills education as a vital aspect of digital citizenship and proposed a digital competence framework—DigComp 2.0—for the European Union. DigComp 2.0 consists of five competencies specific to digital skills education: information and data literacy, 2) communication and collaboration through digital technologies, 3) digital content creation, 4) safety, and 5) problem-solving (Vuorikari, Kluzer, & Punie, 2022; Vuorikari et al., 2016). Regarding the development and study of digital citizenship, Ribble and Bailey (2007) also propose nine dimensions for teaching and studying digital citizenship in schools: 1) digital access, 2) digital commerce, 3) digital communication, 4) digital literacy, 5) digital etiquette, 6) digital law, 7) digital rights and responsibilities, 8) digital health and well-being, and 9) digital security.

About teaching strategies for young university students, Kara (2018, p. 183) examined the opinions and practices of university students about digital citizenship, as defined by Ribble and Bailey (2007). The findings indicated that students utilized the online space as a support mechanism for activities in offline settings. More recently, Bocar and Ancheta (2023) investigated the level of knowledge and practice of digital citizenship among undergraduate students. The study employed the nine components of digital citizenship (Ribble & Bailey, 2007) and found that participants "have a sufficient level of knowledge about good digital citizenship. The participants disclosed that they are unaware of the effects of their actions regarding the use of digital technology." (p. 28). In Puerto Rico, concerning education in information competencies at the university level, Ramírez-Acevedo and Maldonado-Rivera (2021) compared the development of information competencies among institutional-level students versus course-level students. They found that course-level students "have greater competency development in the information than students at the institutional level" (p. 2).

In general terms, Puerto Rico is seeing an increase in mobile telephony and mobile internet use, along with the noticeable presence of digital natives in universities. However, no empirical research has been found that explores internet access, the barriers to this access, and the development of digital skills among the university population in Puerto Rico. The study's research problem is to assess digital inequities among university students and to explore how digital skills education can improve university-level education. This study is part of a larger research project on digital inclusion and digital skills in two populations in Puerto Rico (older adults and university-level students) funded by the National Telecommunications and Information Administration. Consequently, this study examined the barriers to internet access and adoption and the importance of digital skills education for internet use. The research questions (RQs) for this study were as follows:

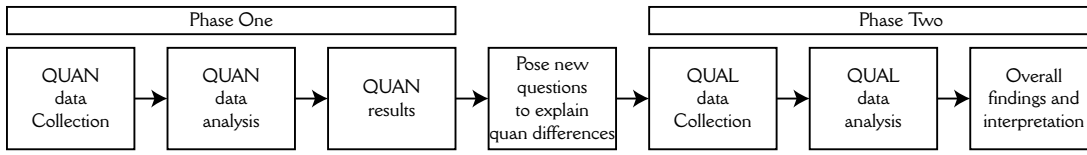
1. RQ 1. What barriers do low-income college students in Puerto Rico face in accessing and adopting broadband internet services?
2. RQ 2. How and to what extent does digital skills education improve the adoption of broadband internet services among low-income college students?
3. RQ 3. What practices have been implemented to improve access to and adoption of internet services among university students, which could be valuable for government agencies and educational organizations in Puerto Rico?

3. Methodology

3.1. Research Design

This study employed a mixed sequential design (Creswell & Plano Clark, 2007), utilizing data collected during the quantitative phase to inform the subsequent qualitative phase. In the quantitative phase, an entry questionnaire was administered to a sample of fifty (N=50) students. Following this, the participants in the sample were offered a workshop focused on developing digital skills. Finally, an exit questionnaire was administered. In the qualitative phase, the information from the quantitative phase was used to formulate guiding questions for a focus group conducted with six students who participated in the quantitative phase. The focus group aimed to deeply explore the meanings associated with the workshop experience and the responses provided by participants during the quantitative phase (Figure 1).

Figure 1: Mixed Sequential Design.



Source: Creswell, J. W., & Plano Clark, V. L. (2007).

3.2. Sampling and Population

This study was conducted at a private university in the Municipality of Carolina, Puerto Rico. This university provides undergraduate and graduate academic programs across various fields. The population for this study consists of approximately 4,000 undergraduate students at this institution. These students come from ethnic minorities in the United States, representing individuals from low-income households who utilize the Pell Grant to finance their college education.

In the quantitative phase, a sample of fifty (50) university students was selected based on a non-probabilistic convenience sampling (Ary et al., 2010; Fraenkel, Wallen, & Hyun, 2012; Gay, L., Mills, G., & Airasian, P., 2012) from a total of 214 students who participated in fifteen workshops on digital skills. The criteria for sample selection were: 1) being an officially registered student, 2) possessing an institutional email address, and 3) being 21 years old or older. The ages of these students ranged from 21 to 34 years. Thirty-one (31) were women, and nineteen (19) were men. Four (4) subjects identified as Black or African American, forty-two (42) as Latino/Hispanic, and four (4) as White. Forty-one (41) subjects were pursuing a bachelor's degree, while nine (9) were studying for an associate degree.

3.3. Data Collection and Instrument

In the quantitative phase, entry and exit questionnaires were utilized. The entry questionnaire contains twenty-four (24) questions, distributed as follows: seven (7) on demographic aspects, eleven (11) on barriers related to broadband internet usage, five (5) on digital knowledge or skills (i.e., digital literacy), and one (1) on practices for enhancing access to and adoption of technology. The average completion time for this questionnaire was fifteen (15) minutes. The exit questionnaire consists of twenty (20) questions, distributed as follows: four (4) on barriers related to broadband internet usage, six (6) on knowledge of digital skills, nine (9) on skills for accessing and adopting technology, and one (1) on practices for enhancing access to and adoption of technology. The average completion time for this questionnaire was twelve (12) minutes.

The questionnaires underwent the content validity process, which involved evaluations from judges. The judges' observations and recommendations were reviewed and integrated into the final versions of these instruments. The Content Validity Index (CVI) for the input questionnaire was 0.92, while for the exit questionnaire, it was 0.82. Inter-rater reliability (IRR) was also calculated for the input questionnaire (IRR 57%) and the exit questionnaire (IRR 63%). Both the CVI and IRR values satisfy the minimum criteria for this type of instrument.

The qualitative phase utilized focus groups as a data collection technique. The focus group followed a protocol of eight guiding questions (i.e., in-depth questions). The study investigators examined the protocol for guiding questions to refine it and ensure it achieved the established purpose.

3.4. Research Procedure

The research procedure in the quantitative phase involved: 1) administration of an entry questionnaire to the participants, 2) participation of the participants in the workshop on digital skills, and 3) finally, the participants completed the exit questionnaire. These questionnaires were administered electronically via the Microsoft Forms platform. Two specialists with an appropriate academic background facilitated each digital skills workshop session. The principal investigator oversaw the administration of both the entry and exit questionnaires. The workshop constituted an educational intervention (learning experience). The duration of the workshop ranged from 30 to 45 minutes.

The digital skills workshop was introductory in nature. Topics covered included a selection of concepts (broadband internet, digital divide, digital equity, and digital skills), the selection and critical use of websites and social networks, and content creation for information or entertainment on the internet and social media using the digital applications Canva and CapCut. The teaching strategy for the digital skills workshop combined conceptual discussions—requiring a certain level of abstract thinking—with the practical use of the Canva and CapCut applications. All participants in the quantitative and qualitative phases signed a consent form to participate in the study voluntarily. The study adhered to the permitting protocols established by the university's Institutional Review Board (IRB).

In the qualitative phase of the study, the principal investigator selected six (6) subjects using non-probability convenience sampling (Ary et al., 2010) from the fifty (50) subjects who participated in the quantitative phase. The selected subjects participated in a focus group.

To carry out the qualitative phase, the principal investigator selected six (6) subjects who participated in the quantitative phase based on availability to participate in a focus group. These six subjects were invited to the university to a suitable location to conduct the focus group. The co-investigator moderated the focus group and administered the guiding question protocol. The focus group lasted thirty-seven minutes.

4. Results

In analyzing quantitative information, we generated figures and tables to describe the behavior of variables and used inferential statistics to establish differences between groups. The results of the entry and exit questionnaires focused on barriers related to internet access, the characteristics of the subjects' internet access, their satisfaction with the administered workshop, and the differences identified in their perception of learning.

4.1. Barriers to Accessing the Internet

Many participants did not identify barriers to accessing and adopting broadband internet services at home or work (Table 1). Likewise, economic and geographical factors were not perceived as significant obstacles. This finding suggests that access challenges may extend beyond socioeconomic and geographical considerations.

Table 1: Barriers to Accessing the Internet.

Questions	Alternatives	Percentage
What are the barriers to accessing internet services outside of your work?	Economic	24%
	Geographic	14%
	Other	22%
	I prefer not to answer.	40%
What are the barriers (obstacles) to internet services outside of your home?	Economic	16%
	Geographic	16%
	Other	24%
	I prefer not to answer.	38%
	Economic and Geographic	4%
What are the obstacles you face in accessing internet services outside of your home?	Economic	8%
	Geographic	16%
	Other	32%
	I prefer not to answer.	44%

4.2. Internet Access

The results indicate that a very high percentage of the participants (100%) own a mobile phone and have internet access at home (Table 2). These findings suggest that participants possess the means and financial resources to develop and apply the digital skills necessary to function in a technological environment where mobile phones and mobile internet are prevalent. The participants' access to the internet outside of work (38%) and at home (32%) may reflect their high level of connectivity (when combining the two percentages). This high level of connectivity would align with a mobile phone with internet access and support the development of digital skills. Additionally, most participants (90%) do not receive FCC's financial subsidies, such as the discount provided by the Lifeline program for wireless phone service, and

the Affordable Connectivity Program (ACP), a discount for broadband connectivity service. [1] In these subjects, having a mobile phone and access to the internet is not hindered by not receiving economic subsidies. The findings evidence these subjects' immersion in mobile telephones and internet connectivity (Generation of digital natives).

Table 2: Percentages of Internet Access in the Entry Questionnaire.	
Entry Questionnaire	
Questions	Respond Yes
Do you have Internet access service on your mobile phone?	100%
Do you have Internet access service in your home?	94%

Similarly, the subjects expressed both positive and critical attitudes regarding their access to the internet (Table 3). The entry and exit questionnaires indicated that the internet positively impacts their lives. The mentioned aspects are fundamental to access. In other words, the significance of the internet for performance or execution in today's world is acknowledged. Furthermore, the subjects believe that internet access requires improvement to meet the demands of all their activities. These points emphasize an acknowledgment of the internet's importance and reflect a positive attitude towards its use. It's also crucial to highlight that the subjects' interest in participating in digital skills workshops, both before (80%) and after (76%) the workshop, demonstrates not only their desire for improvement but also their recognition of the relevance of internet access and adoption.

Table 3: Comparison of the Entry and Exit Questionnaire on Internet Access.		
Questions	Entry Questionnaire	Exit Questionnaire
	Respond Yes	Respond Yes
Does Internet access have a positive effect on your life?	94%	98%
Can Internet access be improved in your home?	68%	68%
Are you interested in participating in an additional workshop on digital skills?	80%	76%

The participants indicated the benefits they gained from the conducted workshop. More than 90% of the participants reported that the workshop helped develop the following skills: 1) completing procedures online with the digital government (e-government), 2) engaging in e-commerce transactions, 3) scheduling medical appointments or using telehealth websites (e-health), 4) performing work-related tasks, such as applying for jobs and uploading a resume to a website (e-employment), and 5) participating in online education-related activities (e-education), such as using websites with educational content and/or exercises, among others (Table 4). The study participants overwhelmingly endorse the workshop's usefulness in their academic, professional, and daily activities. This usefulness becomes significant when the information provided reflects a consistent and unanimous position among the sample.

Table 4: Percentage of Responses Regarding the Usefulness of the Workshop.	
Premises	Yes/ Partially
Conducting procedures online with the digital government (digital government)	90%
Carry out e-commerce procedures, such as purchasing products and managing a bank account	96%
Conduct online activities related to telehealth, such as medical appointments.	96%
Engage in online activities related to work, such as applying for a job and uploading a resume to a website.	98%
Carry out online activities related to educational services, such as using a website with educational content and/or exercises.	96%
Use the codes of ethics, the standards of communication moderation and conduct (Netiquette) on the Internet and social media.	98%
Understand the limits of freedom of expression as hate speech and damage to reputation.	100%

The results indicate a variation in the subjects' perceptions of knowledge or learning regarding the concepts of the digital divide, digital equity, broadband internet, and digital skills when comparing data from the pre-workshop questionnaire to that of the post-workshop questionnaire (Table 5). In other words, the percentage of responses to each statement shows an increase in the post-workshop questionnaire. Thus, it is

1. The ACP program ended on June 1, 2024.

evident that there has been a rise in the subjects' perception of knowledge concerning these concepts since they participated in the digital skills workshop. These results imply that the subjects recognize the workshop's contribution to their understanding of concepts related to digital skills. The workshop is associated with a different and more complex level of understanding of concepts such as broadband internet, the digital divide, and digital equity. Grasping and applying these concepts suggests that the subjects have developed analytical and critical thinking skills.

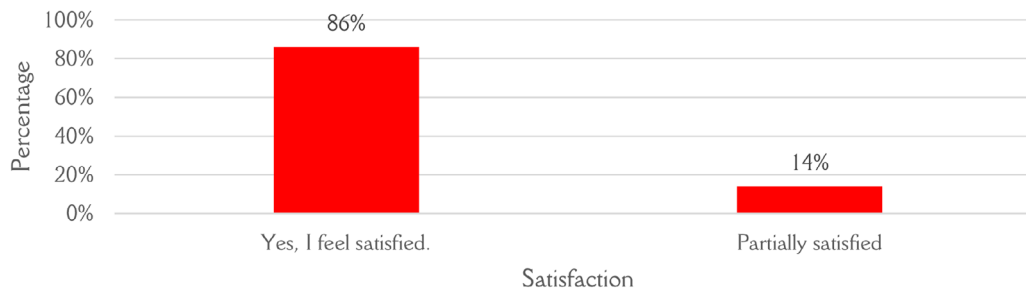
Table 5: Results of the Entry and Exit Questionnaires in the Knowledge Premises.

Questions	Entry Questionnaire Frequency and Percentage "Respond Yes"	Exit Questionnaire Frequency and Percentage "Respond Yes"
Do you know the term broadband Internet?	19 (38%)	48 (96%)
Do you know the term digital divide?	18 (36%)	48 (96%)
Do you know the concept of digital equity?	12 (24%)	47 (94%)
Do you know the term digital skills?	36 (72%)	38 (76%)

4.3. Satisfaction with the Workshop

The participants in this study expressed a high level of satisfaction (100%) regarding the workshop development and the overall results it encompasses. Figure 1 indicates that 86% of participants are completely satisfied, while 14% are partially satisfied. This information reflects a positive opinion about the appropriateness and relevance of the teaching strategy used in the workshop. Satisfaction is crucial for acceptance and positive evaluation of the processes. In this case, the subjects' satisfaction serves as evidence supporting the strong structure and processes of the instructional treatment in this study.

Figure 2: Satisfaction of the Participants with the Workshop on Digital Skills.



The paired *t*-test results indicate a significant improvement in the perception of knowledge or learning between the pre-test and post-test outcomes related to the concepts of digital divide, digital equity, broadband, and digital skills (Table 6). This improvement is consistent and significant across all four concepts, suggesting that students perceive an enhanced understanding of these topics.

Table 6: Results of the Paired *t*-Test.

Questions	Mean	$p \leq 0.00$
Do you know the term broadband Internet? Entry	0.38	**
Do you know the term broadband Internet? Exit	0.96	
Do you know the term digital divide? Entry	0.36	**
Do you know the term digital divide? Exit	0.96	
Do you know the term digital equity? Entry	0.24	**
Do you know the term digital equity? Exit	0.94	
Do you know the term digital skills? Entry	0.72	
Do you know the term digital skills? Exit.	1	**
** Significance $p \leq 0.05$		

In general terms, the average level of knowledge regarding the concepts of broadband, digital divide,

digital equity, and digital skills was found to be significant when comparing the pre- and post-workshop results (Table 7). These findings demonstrate a gain in the perception of knowledge or learning when comparing the measurements from the entry and exit questionnaires. This gain supports the participants' acknowledgment of the achievement of instruction in digital skills. The results are consistent both in the participants' overall perception of the concepts addressed in the workshop and their perception of each concept developed during the session.

Table 7: Results of *t*-Test for General Knowledge.

Knowledge	Average	Sig
Entry	0.43	0.000 **
Exit	0.97	
**Significance $p \leq 0.05$		

4.4. Moderation Standards and Moral Values in Online Communication

The exit questionnaire results indicated that most participants (98%) reported being able to use or partially use the codes of ethics, communication moderation standards, and conduct related to the internet and social media. These findings highlight the workshop's contribution to the participants' education in digital skills. Furthermore, the participants demonstrated a high level of understanding (100%) regarding the limits of freedom of expression, including hate speech and harm to reputation, which contributes to their overall development and positive behavior in a digital environment.

4.5. Utility of the Workshop for the Selection and Critical Use of Websites

The workshop on digital skills addressed the identification of websites and digital applications for interaction in five types of online spaces: 1) digital government, 2) e-commerce, 3) telehealth, 4) online job searching, and 5) online education. After participating in the workshop and regarding the ability to interact in online spaces, the subjects expressed themselves as follows:

- 72% trained and 18% partially trained to carry out procedures with the digital government,
- 94% trained and 2% partially trained to carry out procedures related to e-commerce,
- 84% trained and 12% partially trained to carry out activities related to telehealth, such as medical appointments,
- 96% trained and 2% partially trained to perform activities related to job searching on the Internet, such as applying for a job and uploading a resume to a website,
- 92% trained and 4% partially trained to perform activities related to online education, such as using a page with educational content and/or exercises.

When evaluating the overall totals for each of the online scenarios, a significant level of training is noted for activities (i.e., utility) linked to online job searching (98%), e-commerce (96%), online education (96%), telehealth (96%), and digital government (90%).

Regarding the category of learned knowledge, the participants expressed that they learned concepts such as the digital divide and broadband internet. They stated that the workshop helped create passwords to enhance the security of personal and banking information. The results in the quantitative phase presented a varied scenario. The participants express that education in digital skills is a latent need, access to the internet is a present element, and satisfaction is an indicator of the acceptance of the instruction. Similarly, workshop instruction is supported by increased knowledge of the subjects, which highlights this type of strategy for future studies in the field.

4.6. Qualitative Phase

4.6.1. Qualitative Results

After collecting information from the qualitative phase, the respective analysis was conducted. The focus group questions considered the study's research questions and the core aspects of the quantitative findings that warranted further exploration. In the qualitative analysis, the responses of the focus group subjects were initially transcribed verbatim. Subsequently, the information was coded, and the emerging categories were refined. This process was developed within Wolcott's (1994) DAI qualitative analysis

framework. Before starting the focus group, participants were assigned a numeric code. The quotes from the moderator and the participants are identified with the letters M and P, respectively, along with the number assigned to each participant.

In this phase, the following categories emerged: 1) learning experience, 2) application-usefulness of the workshop, 3) needs, 4) satisfaction with the treatment, and 5) recommendations.

4.6.2. Learning Experience

The identification of the particularities or characteristics of the subjects were experienced during the learning process or developing skills during the intervention (workshop). This category captured the positive experiences of the participants and the difficulties they faced in learning the concepts. The following are examples of the participants' (P) responses that belong to this category:

Moderator: How do you describe your experience in the digital skills workshop?

P1: "... so I understand that it was quite informative, that you really learn about what the digital divide is, and that you can understand from there, from that same workshop, how we can work from the outside supporting the elimination of that digital divide."

P2: "The concept that interested me the most was broadband. I had heard that concept before, but I didn't know the definition as such, and I didn't know exactly what it meant... and, well, thanks to the workshop, I was able to learn the definition and learn what it was. And I was also struck by the digital literacy part."

The participants highlighted the learning element and the alternative to improve the current scenarios related to the concepts. Other participants emphasized additional aspects of the workshop, such as its interesting nature, the workshop's dynamism, and the clarification of concepts:

P3: "The workshop, for me, was very informative, not only in terms of using the CapCut application to edit videos and some of the techniques they use that I didn't even know could be used for that, but they also taught other things about Canva that I had never considered could be used for my professional purposes."

P4: "My experience was good because I learned concepts that I didn't know before, but also, I mean, I had an idea of a concept, and when they defined it and explained it, I realized I was wrong. I mean, I was able to modify that information, and I also realized that I actually knew quite a bit about some things. Sometimes, you feel like you're far from technology, but you're not. I had quite a lot of knowledge, and for me, it was quite dynamic and enjoyable."

The participants also mentioned the development of skills in using some digital tools, such as Canva and CapCut:

P2: "I learned several concepts and definitions about the digital divide. Also, I think what helped me the most was the part about CapCut. Because I had never used it before, I believe that was the most beneficial part and what will help me the most. And, well, I also learned a bit more about Canva. I already knew how to use it, but they helped me understand other things that I might not have known."

P4: "I learned some digital skills and also how to use Canva a little more in-depth..."

P5: "The workshop helped me with several things. … The part about CapCut really caught my attention because I hardly ever used it, … but for my professional use, it helped me a lot, and I literally downloaded it recently to keep exploring it."

The difficulties that the participants experienced in the workshop are identified in the following responses:

P1: "For me, it would be the digital skills part. Because, in a way, when you hear 'skills,' you have to understand whether it means you need to have the skill yourself or if it's something that happens digitally. So, when digital skills are combined, you need to—or at least I need to—understand that definition more deeply or have some context to fully grasp it."

P4: "... when I first saw it, it was Digital Equity. At that moment, I thought, wait, is this what I think it means or not? But when they explained it in the workshop... I was able to understand that it refers to everyone having the same opportunities. But at first, I was like, wait a minute, what is digital equity? It was a little difficult for me to understand it."

P5: "... the terms that were a little more complicated for me to understand were digital divide and digital equality. After the workshop... I have a clearer understanding of what each one means."

The participants emphasized their learning experiences across various contexts, from acquiring concepts and the workshop's dynamic nature to developing and applying digital skills. These findings confirm the relevance and suitability of the instructional approach for the sample population. Furthermore, participants noted specific challenges related to understanding the concepts, suggesting an opportunity for future interventions with similar groups.

4.6.3. Application - Usefulness of the Workshop

This category refers to the scenarios participants indicated in which they can apply what they learned, or the skills developed during the workshop. It also identifies the elements participants emphasize to assess the usefulness of the workshop offered. This usefulness may relate to the information received, the dynamism, or the relevance of the skills developed. The following responses from participants are included in this category:

Moderator: What application do you identify for the concepts and skills you developed in the workshop?

P1: "... from the workshop, I learned several techniques that I didn't know how to use. I learned to be more creative with my videos, using all the tools like the green screen, adding texts. I've developed that editing even more, at least in the professional field."

P2: "Well, I already knew how to use Canva, but thanks to the workshop... I can now use it to create presentations and improve them. And with CapCut, after taking the workshop, I can start using it to edit videos, podcasts, and audio. In fact, I recently had to make a podcast, and thanks to the workshop, I was able to use CapCut to edit it."

P4: "In the case of the academic and professional field, I do use Canva a lot for presentations... unless the professor says no, that it has to be PowerPoint. I also use Canva for the association to create promotions, invitations, etc."

P5: "Basically, the main thing I use Canva for is academic purposes. I create all my presentations there because I can design them in my own style."

The previous information demonstrates the varied applications of digital tools that the participants utilize. They mention using Canva to create presentations in their professional and academic lives. Additionally, the participants consider CapCut an essential tool for video or podcast editing, among other applications. In this regard, the participants' use of digital applications, such as Canva and CapCut, is proposed as a teaching strategy for developing communication practices based on content creation.

The participants also specified that the workshop was useful in providing instruction on some digital tools. They relate this usefulness to video editing, adapting the presentation of videos, or even as fundamental elements for developing projects.

Moderator: Did the workshop present any usefulness for you?

P5: "Honestly, the workshop was very informative and dynamic. I even learned a couple of things I didn't know about CapCut, like how to remove the green screen and add a background, as well as how to add a logo with text to the video. I liked it because I'm currently working on a personal project, and I know that both will be beneficial."

P3: "It helped me a lot, and the introduction to CapCut, in particular, was very interesting for me because now I have a way to learn how to edit videos, let's say, for free."

The prior information examined the participants' use of digital applications in various scenarios. As a result, several aspects were identified that could represent significant contributions to the participants' academic and personal development.

4.6.4. Needs category

The needs identified by the participants established a category. This encompasses topics, skills, or tools that participants think they should learn, develop, or utilize. The information in this category is presented below:

Moderator: What topics would interest you in participating in a future workshop on digital skills?

P1: "... AI (artificial intelligence) is something that interests me. I would like to learn about it, how to use it, and the different types of AI that exist. Also, how to apply it to reduce the digital divide. ... I'm open to learning everything related to the internet, so I'm also interested in cybersecurity, whether it's learning certain things like programming..."

P2: "I'm very interested in artificial intelligence... It's present in all applications—it's in Canva, and I believe it's in CapCut as well. I would also be interested in cybersecurity. I think it's very important to know how to protect our information and how to protect ourselves on the internet..."

P4:"... I would also like them to talk about artificial intelligence, specifically how to apply it correctly, how it can be used in the university setting for work, etc."

P5: "... a workshop on artificial intelligence... knowing how to use it, whether for work purposes, as a tool... and another workshop that would be great is on cybersecurity—how to teach people to protect themselves on social networks..."

P6: "... how to properly use AI, and what I also like a lot is cybersecurity—what hacking is and how to prevent it from happening to you."

The specific needs identified by the participants pertain to artificial intelligence as a professional resource, technological applications, and cybersecurity aimed at protecting private information from external agents. The participants focus on topics that currently pose societal challenges in both professional and personal contexts. This contributes to a repository of relevant information that warrants further exploration to tackle these problematic areas within the educational landscape.

4.6.5. Satisfaction with Treatment

In this category, the participants indicate their level of satisfaction with the study's approach and process. They expressed the reasons behind their satisfaction and articulated their enthusiasm regarding the research conducted. The following section presents the participants' statements within this category:

P1: "I honestly enjoyed the experience of participating in the workshop and now here as well. I had never taken part in a focus group before, so it has been a very good experience for me. I learned quite a few things, and I'm gradually putting them into practice, specifically in the professional field, but from now on, I will also try to apply them in my personal life."

P3:"... I loved how they went through explaining the different concepts, especially the videos they showed, particularly the one comparing older adults with the younger generation and how they use social media and technology..."

P5: "The workshop was excellent for me. I was able to refresh my memory, as I mentioned, about Canva and CapCut. I got more involved with them since I used them more when I was younger, and now I'm using them again as an adult."

P6: "... I really loved the workshop. I didn't know much about access... Obviously, I'm trying to learn many things I didn't know, for example, digital access."

The participants' satisfaction is reflected in the development of the workshop skills and the research process. In this way, the participants express their satisfaction in a general or holistic manner regarding the entire study process.

4.6.6. Recommendations Category

This category includes participants' comments on the areas of opportunity they identify for improving treatment or the workshop. Some of the recommendations are cited below:

P2: "I think the workshops should last a little longer because I feel that the information they gave us was beneficial and good, but I feel that they only taught us at least the basics of Canva and CapCut... teaching us a little more about the applications so we know how to use them well and effectively... not just knowing how to do the projects but how to make long-term projects more effective."

P4: "... maybe having a slightly smaller number of students would be better so that the person explaining how to use the application... can make sure that the students are following along and truly learning."

Previous participants indicated that the duration of the workshop is a fundamental element in developing

digital skills. Therefore, they recommend dedicating more time to strengthening skills in using CapCut and Canva. Other participants recommended evaluating or verifying what was learned or developing skills. Among this group, we have:

P3: *"... one recommendation I could give is to provide more opportunities for participants to engage more in the workshop. For example, mini exercises that could last one to two minutes during the workshop so they can apply what they have learned, but in a quick way..."*

The recommendations indicated by the participants are areas of opportunity that deserve consideration for future workshop development. The duration of the activities, the assessment of learning, and the development of skills are genuine elements that warrant special attention.

5. Discussion

RQ 1: What barriers do low-income college students in Puerto Rico face in accessing and adopting broadband internet services?

The results from the questionnaires show that economic and geographic factors are not the main barriers to accessing broadband internet. In this regard, participants either chose not to respond or considered other unspecified barriers. Similarly, during the focus group discussion, participants did not mention any barriers to internet access. Instead, they pointed out the needs necessary to enhance their skill development. Some of the needs mentioned include organizing workshops that would allow them to explore relevant concepts more deeply, providing additional time to develop skills, or offering opportunities to apply these skills in various contexts.

The results also indicate that participants own mobile phones and have internet access at home. These results are consistent with those found by Kerras et al. (2022) who identified that mobile telephony availability is higher in high-income countries and that the internet availability rate among students in high-income countries is 99%. These results are also consistent with Hargittai et al. (2018), who found that most young adults turn to the Internet for information about science and research.

This implies that the means and resources needed to develop and apply digital skills are present in these situations. Likewise, universal access to the Internet facilitates the creation of new associative and organizational forms of political and social advocacy (Naranjo Crespo & Carrasco Temiño, 2022). The generational profile of the participants suggests early exposure to technological tools and information, likely promoting early immersion in technology and the cultivation of digital skills before formal schooling. Furthermore, the university environment fosters the development and application of digital skills among the participants in this sample. This generational group utilizes ICTs to participate in academic, economic, and social interest online environments activities. These online activities are understood within the framework of digital citizenship. The use of technology by university students coincides with the results of Gonzalez and Deng (2023), who found that first-year university students heavily used technology related to social networks, which allowed the development of digital skills that they apply in their educational training.

In general terms, the barriers would be related to the need for education in digital skills, specifically in certain areas among the subjects of this study. The need for training may serve as the basis for various workshops to address the needs of a population with digital skills developed and access to ICTs from an early age. The challenge lies in leveraging the participants' prior knowledge and existing skills to enable their advancement in areas of current interest and cutting-edge fields, such as cybersecurity and artificial intelligence.

RQ 2: How and to what extent does digital skills education improve the adoption of broadband internet services among low-income college students?

The participants reported an increased understanding of the concepts discussed during the workshop, as indicated in the post-workshop questionnaire. These concepts included the digital divide, digital equity, broadband, and digital skills. This improvement was statistically significant ($p < 0.05$). Based on the participants' perceptions, these findings suggest that the workshop effectively provided digital literacy training related to the topics covered. Thus, educating participants in digital skills could promote higher broadband internet adoption among the study's participants.

Furthermore, the high level of satisfaction reported by all participants (100%) indicates that the teaching strategy used during the workshop was appropriate and relevant. The participants' perceived knowledge gain in digital skills and their development and satisfaction levels underscores students' ongoing needs regarding specific aspects of technology knowledge and use. These results coincide with the conclusions of the study by Redda (2024), which established that digital technologies are crucial to improve the teaching, learning and research processes of academic institutions in the context of higher education.

Additionally, participants acknowledged the value of the digital tools and skills covered in the workshop for their academic and professional endeavors. They stressed the importance of developing digital skills in video editing, enhancing video presentations, and creating projects. They also emphasized the use of Canva for crafting presentations in both academic and professional settings, as well as CapCut, which they deemed essential for editing videos and podcasts, among other applications.

The usefulness and application of digital skills, as noted by the participants in this study, warrant special attention in discussions about the importance of digital skills education. From the participants' perspective, the findings illustrate how instructional processes and skill development are essential for engaging in activities in both online and offline environments where academic, professional, and daily life tasks occur. Digital skills education offers both tangible and cognitive tools that enhance the adoption of broadband internet services among university students. In this sense, the results of van Deursen and Helsper (2015) become important, who suggest that highly educated individuals benefit more from the internet than those with less education, especially in the domains of economic commerce, institutional government, and educational outcomes.

The results of this study indicate that instruction in digital skills represents an effective practice for developing these competencies in university students. This result is consistent with what is proposed by the OECD and found by Kerras et al. (2022) which indicate that the use of ICT tools is closely linked to higher education. The high level of satisfaction reported by participants supports the effectiveness of the instructional strategy employed. Participants emphasized the usefulness of learning key concepts, the engaging nature of the instruction, the dynamic structure of the workshop, and the clarification of concepts by contextualizing them within daily and academic life.

RQ 3: What practices have been implemented to improve access to and adoption of internet services among university students, which could be valuable for government agencies and educational organizations in Puerto Rico?

Similarly, the participants identified areas related to digital skills needing additional instruction. There is a strong demand for training in CapCut, Canva, artificial intelligence, and cybersecurity. These identified needs are closely tied to areas that are currently relevant and will remain significant in the near future. In his study, Alonso-Hernandez et al. (2024) also concludes that the ability to create digital content and critically navigate online resources should be fostered through continuous educational programs, as the absence of these skills significantly limits the benefits of digitalization. Additionally, participants offered recommendations for future workshops, including adjusting the duration of activities, incorporating mechanisms to evaluate learning, and providing more opportunities to apply digital skills in professional settings and everyday life.

These recommendations represent valuable opportunities for improvement and deserve specific attention to enhance instructional practices related to digital skills. Given these findings, developing workshops tailored to the needs and expectations of the target population could be advantageous for government agencies and educational organizations aiming to promote digital education among populations like the one in this study. Alonso-Hernandez et al. (2024) indicates that the efforts must be broad and holistic, integrating both the provision of infrastructure and the training in digital skills. The evidence suggests that public policies must be inclusive and designed to provide equitable access to ICT, as well as to foster the creation and use of relevant digital content. Finally, the recommendations identified in this research are highly relevant for creating instructional alternatives that effectively address the needs of this population.

6. Conclusion

The sequential mixed methods design of the study was suitable for exploring access barriers and assessing the pedagogical usefulness of the workshop in developing digital skills. Wolcott's (1994) DAI model aided in qualitative data analysis and offered insights into the meanings associated with the study's purpose.

The questionnaires and focus group served as effective instruments for collecting data that supported the study's objectives. The focus group was particularly effective in gathering in-depth information on digital skills, participants' interests, and communication practices in online environments. Five categories of analysis emerged during the qualitative phase: (1) learning experience, (2) application and usefulness of the workshop, (3) needs, (4) recommendations, and (5) satisfaction with the intervention. However, the study has limitations regarding the sample size in both the quantitative and qualitative phases.

The subjects of the sample belong to a generation with well-developed digital skills. The results show that they own a mobile phone and have internet access at home. Moreover, they demonstrate a high level of connectivity, indicative of having a mobile phone with internet access. Due to digital transformations, the means and resources to develop and implement digital skills are available in the university context. Access to these resources would enable the development of more complex instructional strategies in digital skills and instruction in more specialized areas of technology (i.e., artificial intelligence, cybersecurity, STEM). This situation presents an opportunity to create various workshops and instructional strategies for university students on topics such as digital citizenship and other ICTs (video games and social media).

The sample subjects express a positive attitude towards access to the internet. They indicate, both in the entry questionnaire and the exit questionnaire, that the Internet has a positive effect on their lives. In other words, they acknowledge the relevance of the Internet to today's world. The results gathered from the questionnaires indicate that the subjects do not consider economic and geographical factors as barriers to accessing broadband internet. However, education in digital skills is an area of opportunity that deserves further study.

The paired t-test statistical analysis helped establish differences between the pre- and post-workshop questionnaire results concerning the perception of knowledge or learning as a product of the workshop. There was a significant gain when comparing the subjects' perceptions of learning from the pre-and post-workshop questionnaires. This gain was also reflected in understanding concepts such as broadband internet, digital divide, digital equity, and digital skills.

Subjects reported high satisfaction with the instructional model developed in the digital skills workshop. The instruction on digital skills provided in the workshop represents an appropriate and alternative practice for developing digital skills among university students. The thematic design and instructional approach of the digital skills workshop combined concept discussions, which require a level of abstract thinking, with practical use of the digital applications Canva and CapCut during the workshop. Ninety (90%) or more indicated several skills the workshop helped develop, such as completing online procedures with the digital government, carrying out e-commerce transactions, scheduling medical appointments, or using websites.

Technological tools such as CapCut, Canva, artificial intelligence, and cybersecurity emerged as high-demand training areas among the subjects in the sample. The subjects in the sample use technological tools like CapCut and Canva in their daily, academic, and professional lives. This places them among consumers of software and technological tools. Some of the needs indicated by the subjects of this study are related to the development of workshops that allow them to deepen their understanding of the concepts, give them more time to develop skills or apply the skills discussed in the workshop in different contexts.

6.1. Recommendations and implications

The study provides recommendations for further exploration of this research topic. For example, it suggests conducting similar studies with university populations from various socio-economic backgrounds, accounting for gender, age, and educational level differences, as well as increasing the sample size. Furthermore, the findings of this research may serve as a foundation for future comparative studies on the barriers and practices related to Internet adoption, digital skills education, and the development of digital citizenship across different populations.

The study's implications extend to various scenarios. First, higher education institutions may incorporate topics related to digital citizenship into their curricula, as this can promote social inclusion and digital equity. This may enhance students' university-level education in offline and online environments, align with marketplace demands for skilled labor, and promote social inclusion. Secondly, education in digital applications, such as CANVA and CapCut, as well as Artificial Intelligence and Cybersecurity, are relevant topics to the subjects. Third, the findings of this study encourage policymakers and higher education institutions to incorporate academic research into initiatives that enhance digital skills education. Specifically,

this study provides a theoretical and methodological foundation for future research with similar objectives. Fourth, additional interdisciplinary studies are necessary to address students' interests and provide quality learning environments, as well as to meet marketplace demands for skilled labor. Last, the relevance and application highlighted by the subjects of this study regarding digital skills warrant particular attention in discussions about government efforts and those of other stakeholders to advance education in digital skills and digital citizenship.

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References

Alonso-Hernandez, L., Huesca-Gastelum, M., Cruz-Cabrera, B., & Gonzales-Torres, X. (2024). Beyond Access: Public Policies and Digital Skills as Determinants of Digital Inclusion. *Modelling, Measurement and Control D*, *45*(1-4), 43-48. https://doi.org/10.18280/mmc_d.451-406

Ary, D., Jacobs, L., Sorensen, C., & Razavieh, A. (2010). *Introduction to Research in Education* (8th ed.). Wadsworth, Belmont.

Bocar, A., & Ancheta, R. (2023). Exploring Students' Digital Citizenship: Its Importance, Benefits, and Drawbacks. *Journal of Business, Communication & Technology*, *2*(2), 28-33. https://doi.org/10.56632/bct.2023.2203

Castells, M. (2001). *The Internet Galaxy: Reflections on the Lnternet, Business and Society*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199255771.001.0001

Creswell, K. W., & Plano Clark, V. L. (2007). *Designing and Conducting Mixed Methods Research*. Sage Publications.

DiMaggio, P., Hargittai, E., Celeste, C., & Shafer, S. (2004). Digital Inequality: From Unequal Access to Differentiated Use. In K. Neckerman (Ed.), *Social Inequality* (pp. 355-400). Russell Sage Foundation. https://www.webuse.org/pdf/DiMaggioEtAl-DigitalInequality2004.pdf

Drljić, K., Čotar Konrad, S., Rutar, S., & Štemberger, T. (2025). Digital Equity and Sustainability in Higher Education. *Sustainability*, *17*(5), 2011. https://doi.org/10.3390/su17052011

Fraenkel, J., Wallen, N., & Hyun, H. (2012). *How to Design and Evaluate Research in Education* (8th ed.). McGraw Hill.

Gallardo, R., & Geideman, C. (2019, Feb 20). Digital Distress: What is it and who does it affect? Part 1. *Medium*. https://medium.com/design-and-tech-co/digital-distress-what-is-it-and-who-does-it-affect-part-1-e1214f3f209b

García-Martínez, J.-A., Rosa-Napal, F.-C., Romero-Tabeayo, I., López-Calvo, S., & Fuentes-Abeledo, E.-J. (2020). Digital Tools and Personal Learning Environments: An Analysis in Higher Education. *Sustainability*, *12*(19), 8180. https://doi.org/10.3390/su12198180

Gay, L., Mills, G., & Airasian, P. (2012). *Educational research: Competencies for analysis and applications* (10th ed.). Pearson Education.

Gonzalez, E., & Deng, X. N. (2023). Social Inclusion: The Use of Social Media and the Impact on First-Generation College Students. *Journal of the Association for Information Systems*, *24*(5), 1313-1333. https://doi.org/10.17705/1jais.00792

Gorski, P. (2005). Education Equity and the Digital Divide. *AACE Journal*, *13*(1), 3-45. https://www.learntechlib.org/primary/p/6570

Gurstein, M. (2007). *What is Community Informatics (and Why Does It Matter)?* Polimetrica s.a.s.

Hargittai, E. (2002). Second-Level Digital Divide: Differences in People's Online Skills. *First Monday*, *7*(4), e94. https://firstmonday.org/ojs/index.php/fm/article/view/942

Hargittai, E., Füchslin, T., & Schäfer, M. S. (2018). How Do Young Adults Engage With Science and Research on Social Media? Some Preliminary Findings and an Agenda for Future Research. *Social Media + Society*, *4*(3), 2056305118797720. https://doi.org/10.1177/2056305118797720

Hargittai, E., & Hinnant, A. (2008). Digital Inequality: Differences in Young Adults' Use of the Internet. *Communication Research*, *35*(5), 602-621. https://doi.org/10.1177/0093650208321782

Kara, N. (2018). Understanding University Students' Thoughts and Practices about Digital Citizenship: A Mixed Methods Study. *Journal of Educational Technology & Society*, *21*(1), 172-185. https://www.jstor.org/stable/26273878

Kerras, H., Bautista, S., Piñeros Perea, D. S., & de-Miguel Gómez, M. D. (2022). Closing the Digital Gender Gap among Foreign University Students: The Challenges Ahead. *Sustainability*, *14*(19), 12230. https://doi.org/10.3390/su141912230

Koenig, R. (2022, Nov 11). Can Colleges Reach Beyond Campus to Foster 'Digital Equity' in Communities? *EdSurge*. https://www.edsurge.com/news/2022-11-11-can-colleges-reach-beyond-campus-to-foster-digital-equity-in-communities

McCabe, M. B. (2013). US Hispanics Go Mobile: Adoption and Marketing Engagement Trends. *International Journal of Mobile Marketing*, *8*(2), 67-74. https://mmaglobal.com/files/vol8no2/vol8no2-6.pdf

Méndez-Domínguez, P., Carbonero Muñoz, D., Raya Díez, E., & Castillo De Mesa, J. (2023). Digital Inclusion for Social Inclusion. Case Study on Digital Literacy. *Frontiers in Communication*, *8*, 1191995. https://doi.org/10.3389/fcomm.2023.1191995

Morduchowicz, R. (2020). *La ciudadanía digital como política pública en educación en América Latina*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000376935

Mossberger, K., Tolbert, C. J., & Anderson, C. (2016). The mobile Internet and digital citizenship in African-American and Latino

communities. *Information, Communication & Society*, *20*(10), 1587-1606. https://doi.org/10.1080/1369118X.2016.1243142

Mossberger, K., Tolbert, C. J., & Hamilton, A. (2012). Broadband Adoption| Measuring Digital Citizenship: Mobile Access and Broadband. *International Journal of Communication*, *6*, 2492-2528. https://ijoc.org/index.php/ijoc/article/view/1777

Mossberger, K., Tolbert, C. J., & McNeal, R. S. (2008). *Digital Citizenship: The Internet, Society, and Participation* (1st ed.). MIT Press. https://doi.org/10.7551/mitpress/7428.001.0001

Napoli, P. M., & Obar, J. A. (2013). *Mobile Leapfrogging and Digital Divide Policy: Assessing the Limitations of Mobile Internet Access* (Fordham University Schools of Business Research Paper No. 2263800). New America Foundation. https://doi.org/10.2139/ssrn.2263800

Naranjo Crespo, M., & Carrasco Temiño, M. A. (2022). Participación estudiantil e inclusión digital en la universidadun estudio en contextos iberoamericanos. *Foro de Educación*, *20*(1), 10-38. https://doi.org/10.14516/FDE.957

Negociado de Telecomunicaciones de Puerto Rico. (2024, August). *Estadísticas de la industria de las telecomunicaciones en Puerto Rico*. Informe mensual. https://www.net.jrsp.pr.gov/cumplimiento

Prendes-Espinosa, M., García-Tudela, P., & Solano-Fernández, I. (2020). Igualdad de género y TIC en contextos educativos formales: Una revisión sistemática. *Comunicar*, *63*, 9-20. https://doi.org/10.3916/C63-2020-01

Ramírez-Acevedo, I., & Maldonado-Rivera, I. (2021). Estudio comparativo de las competencias informacionales en estudiantes subgraduados. *ACCESO. Revista Puertorriqueña de Bibliotecología y Documentación*, *2*(1). https://revistas.upr.edu/index.php/acceso/article/view/18762

Redda, E. H. (2024). Digital Transformation in South Africa's Higher Education Landscape. *African Journal of Development Studies*, *14*(3), 459-472. https://doi.org/10.31920/2634-3649/2024/v14n3a21

Reisdorf, B., & Rhinesmith, C. (2020). Digital Inclusion as a Core Component of Social Inclusion. *Social Inclusion*, *8*(2), 132-137. https://doi.org/10.17645/si.v8i2.3184

Ribble, M., & Bailey, G. (2007). *Digital Citizenship in School*. International Society for Technology in Education.

Rosario-Albert, L. (2016). *Redes, Estado, Empresa y Telecomunicaciones en Puerto Rico*. San Juan: Junta Reglamentadora de Telecomunicaciones de Puerto Rico.

Stern, M. J., Adams, A. E., & Elsasser, S. (2009). Digital Inequality and Place: The Effects of Technological Diffusion on Internet Proficiency and Usage across Rural, Suburban, and Urban Counties. *Sociological Inquiry*, *79*(4), 391-417. https://doi.org/10.1111/j.1475-682X.2009.00302.x

Taglang, K. (2024, March 14). *How the FCC got to 100/20. Digital Beat*. Benton Institute for Broadband and Society. https://www.benton.org/blog/how-fcc-got-10020

US Census Bureau. (2023). *S0101: Age and Sex* [Data Table]. American Community Survey 1-Year Estimates. https://data.census.gov/table/ACSST1Y2023.S0101?g=040XX00US72

Van Deursen, A. J. A. M., Helsper, E., Eynon, R., & Van Dijk, J. A. G. M. (2017). The Compoundness and Sequentiality of Digital Inequality. *International Journal of Communication*, *11*, 452-473. https://ijoc.org/index.php/ijoc/article/view/5739

van Deursen, A. J. A. M., & Helsper, E. J. (2015). The Third-Level Digital Divide: Who Benefits Most from Being Online? In *Communication and Information Technologies Annual* (Vol. 10, pp. 29-52). Emerald Group Publishing Limited. https://doi.org/10.1108/s2050-206020150000010002

Van Dijk, J. A. (2005). *The Deepening Divide: Inequality in the Information Society*. Sage Publications. https://doi.org/10.4135/9781452229812

Vuorikari, R., Kluzer, S., & Punie, Y. (2022). *DigComp 2.2: The Digital Competence Framework for Citizens-With New Examples of Knowledge, Skills and Attitudes*. Publications Office of the European Union. https://doi.org/10.2760/115376

Vuorikari, R., Punie, Y., Gomez, S. C., & Van Den Brande, G. (2016). *DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model* (No. JRC101254). Joint Research Centre. https://doi.org/10.2791/607218

Warschauer, M. (2003). *Technology and Social Inclusion: Rethinking the Digital Divide*. MIT Press. https://doi.org/10.7551/mitpress/6699.001.0001

Warschauer, M., & Matuchniak, T. (2010). New Technology and Digital Worlds: Analyzing Evidence of Equity in Access, Use, and Outcomes. *Review of Research in Education*, *34*(1), 179-225. https://doi.org/10.3102/0091732X09349791

Wolcott, H. F. (1994). *Transforming Qualitative Data: Description, Analysis, and Interpretation*. Sage Publications.