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BRIDGING THE THIRD-LEVEL DIGITAL DIVIDE: AN EXAMINATION OF DIGITAL INEQUALITIES AMONG DIFFERENT GROUPS IN HIGHER EDUCATION

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ABSTRACT

This research examines digital inequalities in internet competencies among students and educational workers in selected higher education institutions (HEIs) in the northern and southern regions of the Philippines. The study focuses on four dimensions of internet skills: operational, information-navigation, social, and creative skills, and investigates how these skills impact internet usage and tangible outcomes. A survey was conducted with 1160 participants, comprising 782 students and 378 educational workers from 4 colleges and universities. The study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) and Multigroup Analysis (MGA) to compare internet competencies and their effects between the two groups. Results reveal significant differences between students and educational workers. Students demonstrated higher proficiency in creative and social internet skills, while educational workers excelled in information-seeking skills. However, students' lower information-seeking skills were found to hinder their effective use of online resources for academic achievement. Conversely, educational workers' lower creative and social internet skills limited their ability to leverage digital tools for career development. This research highlights the need for targeted interventions to enhance information-seeking skills among students and creative and social internet skills among educational workers. Such interventions could help reduce digital inequalities and improve educational and professional outcomes in Philippine HEIs.

Keywords: multigroup analysis, internet skills framework, educational workers

Introduction

The digital divide, defined as the gap between those who can access and effectively use digital technologies and those who cannot, is a critical issue in contemporary society. This divide reflects broader societal inequalities, including disparities in socioeconomic status, education, and geographic location (OECD, 2001; World Bank, 2024). While early studies on the digital divide focused primarily on access to technology, recent research has expanded to explore digital inequality at multiple levels. These levels include not only access to the internet (first-level digital divide) but also the skills and usage patterns (second-level digital divide) and the tangible outcomes resulting from internet use (third-level digital divide) (Van Deursen & Van Dijk, 2019).

The ability to use the internet effectively is closely linked to positive life outcomes. Hargittai and Hsieh’s (2013) study on the "second-level digital divide" supports Van Deursen et al.'s view that it is not just about access to technology but how well people use it. Their focus on internet literacy aligns with Van Deursen’s emphasis on information and strategic internet skills, showing how varying digital skills contribute to unequal access to online resources.

Robinson et al. (2020) examined digital capital, the resources gained from internet use, and how it can lead to social and economic benefits, such as better job prospects and social mobility. The study emphasizes the third-level digital divide, linking internet use to educational, career advancement, and social inclusion inequalities.

Digital inequality is a growing concern in the Philippines, especially in education. The country's higher education institutions (HEIs) face challenges in providing equitable access to digital resources and skills development. The National Internet Plan, introduced by the Philippine government in 2017, aimed to bridge the digital gap by ensuring widespread internet access by 2022 (Royandoyan, 2021). However, many regions continue to experience limited internet infrastructure and unequal access to digital technologies. Within the ASEAN region, the Philippines falls behind in internet infrastructure. The country's online connectivity is characterized by higher costs, slower speeds, and limited availability compared to its neighboring nations. This disparity results in unequal opportunities for Filipinos to engage in the digital realm (World Bank, 2024). These issues are further exacerbated by varying levels of digital literacy among students and educational workers in HEIs, affecting their ability to engage with digital tools effectively.

This study focuses on selected private HEIs in the northern and southern regions of the Philippines, where digital inequality may pose a significant concern. It focuses on how differences in internet skills—specifically operational, information-navigation, social, and creative skills—impact tangible outcomes. Van Deursen et al. 's (2015) Internet Skills and Helsper et al.’s (2015) research on tangible outcomes serve as the theoretical foundation for this research, offering a comprehensive view of the specific skills necessary for digital engagement and success. By exploring the linkages between internet skills, their usage, and the tangible outcomes, this study seeks to provide insights into how HEIs can address digital inequalities and promote greater digital inclusion.

The following question guides the research: How do digital inequalities in internet competencies (information-seeking, social, and creative skills) affect usage and the tangible outcomes among students and educational workers in selected HEIs in the northern and southern regions of the Philippines? Using a survey of 1160 participants (782 students and 378 educational workers) and employing Partial Least Squares Structural Equation Modeling (PLS-SEM) and Multigroup Analysis (MGA), this study provides insights into how HEIs can address digital inequalities and promote greater digital inclusion.

By investigating digital inequality at the level of skills and outcomes, this research contributes to a deeper understanding of the third-level digital divide in the Philippine educational context. The findings will inform policy and program development to foster digital equity and improve educational and professional outcomes for students and educational workers.

Theoretical Background and Literature Review

Introduction to Digital Inequality

Digital inequality, a multifaceted concept, has evolved from simply addressing access to technology (first-level digital divide) to encompassing the skills required to use digital technologies effectively (second-level digital divide) and the tangible outcomes resulting from this use (third-level digital divide) (Van Deursen & Van Dijk, 2019). Helsper et al. (2015) frame this issue through the lens of digital deprivation, which manifests in various forms:

- Access deprivation: Lack of reliable internet connections or devices
- Skill-based deprivation: Insufficient technical knowledge to use digital tools effectively.
- Compound digital deprivation: Combined challenges leading to disadvantages across multiple areas.
- Sequential digital deprivation: A step-by-step process where one form of deprivation leads to others.

These forms of digital deprivation collectively reinforce social and economic inequalities in our increasingly connected world.

Framework of Internet Skills

To address the second-level digital divide, Van Deursen et al. (2015) propose a framework of internet usage skills comprising four key dimensions: operational, information-navigation, social, and creative skills. This study focuses on the latter three:

While operational skills are fundamental, this study assumes a basic level of these skills among higher education students and staff, focusing instead on the more complex skills that directly impact educational and professional outcomes.

Digital Inequality in Education

Research has consistently demonstrated the importance of internet skills in mitigating digital inequalities, particularly in educational settings. DiMaggio et al. (2004) found that individuals with higher information-navigation skills achieve better educational and professional outcomes. Robinson et al. (2005) linked creative skills to improved job prospects and income levels. These findings underscore the need to understand how different digital skills contribute to bridging the digital divide, especially in developing countries like the Philippines.

The Philippine Context

Digital inequality remains a pressing issue in the Philippines due to uneven internet infrastructure development and unequal access to digital resources (World Bank, 2020, 2024). In 2021, there are 2,396 HEIs in the entire archipelago; 246 are public, and 2,150 are private (CHED, 2021). According to a government report, only 39% of students in HEIs have access to devices suitable for online learning, and 55% of faculty members in HEIs need further training in ICT skills (DBM, 2022). The data from the National ICT Household Survey of 2019 indicates that 17.7% of households had access to the internet at home, with higher rates in urban areas (DICT, 2019). However, digital literacy rates lag behind access, with the Department of Education reporting in 2021 that only 41% of public school students possessed basic digital literacy skills. The Functional Literacy, Education, and Mass Media Survey also found that 69.8% of Filipinos aged 10-64 were digitally literate (PSA, 2019).

Asio et al. (2021) revealed varying digital literacy levels among Filipino students and educational workers, with many lacking the skills to leverage digital tools for education and professional growth fully. This disparity is particularly concerning in higher education, where internet skills are crucial for students and educators. The Philippine Institute for Development Studies (PIDS) reported low digital literacy levels among youth and elderly populations, highlighting the need for comprehensive digital literacy programs (Carpena, 2022). While crucial in shaping students' digital competencies, educational workers may themselves require support to develop creative and social skills relevant to digital learning environments. Educational workers in this study refer to the teaching and non-teaching personnel of the academic institutions.

Research indicates that the digital divide—where certain regions and demographics have limited or no access to the internet and digital technologies—poses a significant obstacle to effective distance learning and the integration of technology in education (Joaquin et al., 2020; Salvador, 2022; Lopena et al., 2021).

Conceptual Framework

Figure 1: Internet Skills (Van Deursen et al., 2015) & Tangible Outcomes (Helsper et al., (2015)

This study adapts the frameworks of Van Deursen et al. (2015) and Helsper et al. (2015) to investigate the second- and third-level digital divides among students and educational workers in selected higher education institutions (HEIs) in the northern and southern regions of the Philippines. By analyzing how information navigation, social, and creative skills differ between these groups and how these skills influence educational and professional outcomes, this research aims to identify key areas of digital inequality. These skills serve as the core constructs of the study. They are hypothesized to influence a range of educational, economic, social, and professional outcomes, thereby providing a structure for investigating digital inequalities across different groups. By analyzing how internet skills translate into tangible benefits in these domains, this research hopes to provide insights into how digital inequalities can be mitigated through targeted interventions to improve specific skill sets.
Our conceptual framework (Figure 1) illustrates the link between internet skills and tangible outcomes in education and professional development. We measure these outcomes through:

- Educational outcomes: academic performance, research productivity, and digital resource utilization
- Professional outcomes: career advancement opportunities, professional network development, and digital workplace competencies

By examining these links, this study seeks to provide insights for developing targeted interventions to bridge the digital divide in Philippine higher education.

Internet Skills as Key Constructs

This framework includes operational skills (basic technical functions), information-navigation skills (ability to search and evaluate online information), social skills (interpersonal communication via digital tools), and creative skills (content creation and collaboration) as the main constructs. These skills are crucial in determining how individuals benefit from the internet, as those who lack these skills are less likely to leverage digital opportunities for education, employment, and social integration (Helsper, 2012; Van Deursen & Van Dijk, 2019). The first-level relationship for these constructs is hypothesized to influence these skill variables in hypotheses 1 to 6 in Figure 2.

Linking Internet Skills and its Usage to Outcomes

The study investigates how social and creative skill differences affect usage and outcomes in economic, cultural, social, and personal domains following the digital inclusion measures in Helsper et al. (2015). These hypothesized linkages are summarized in Figure 2.

Economic *use* generally refers to how individuals utilize resources, particularly the Internet, to achieve financial benefits. The critical economic use variables that contribute to tangible economic outcomes generally include income, employment, education, and property-related activities. These variables relate to how people use the Internet to improve their financial situation, find employment, enhance skills through education, or save money by purchasing goods and services online. Economic use also includes using online platforms to sell products, improve job performance, or access financial services like banking or insurance. These linkages are depicted in hypotheses 7 to 10 for social skills to economic use and hypotheses 11 to 14 for creative skills to economic use.

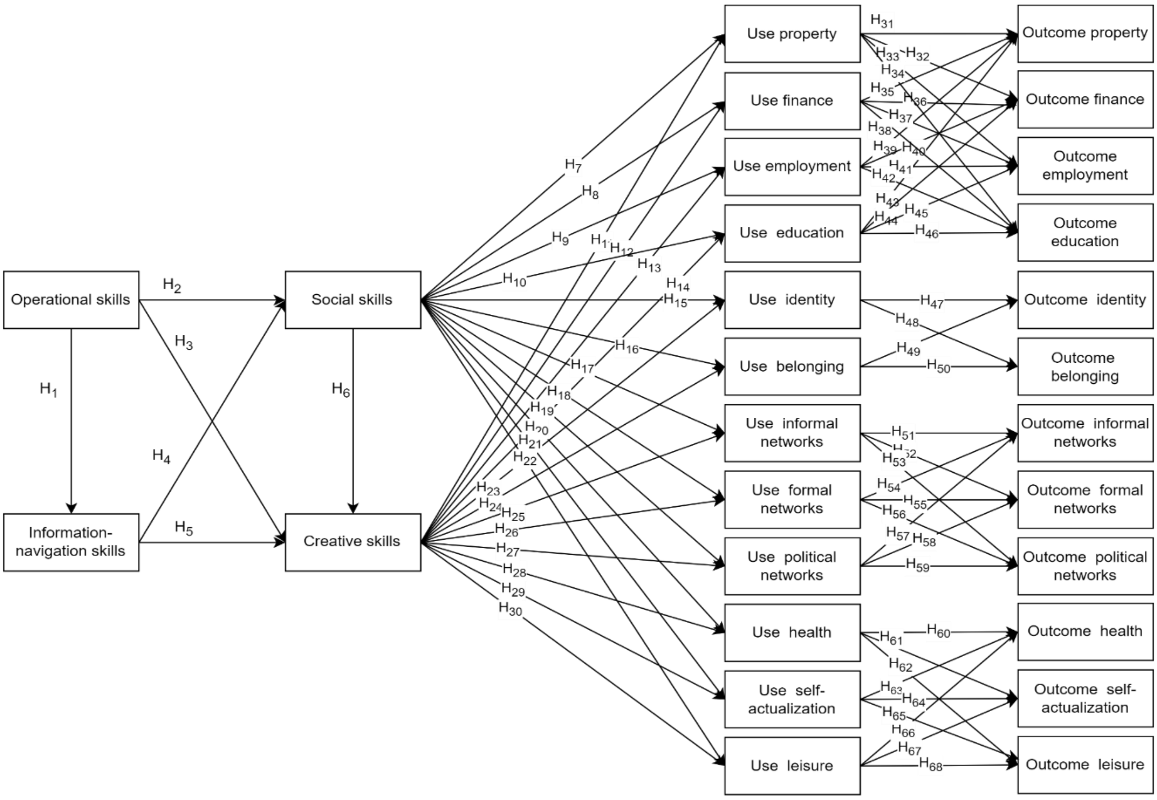

Figure 2**:** Full Model and Hypotheses

Economic *outcomes* refer to the tangible results that impact the financial aspects of an individual's life, often linked to variables such as income, employment, and financial stability. These outcomes can be influenced by access to and the use of online resources, such as job search platforms, online financial services, and educational opportunities. Specific economic outcomes include improvements in financial situation, access to employment opportunities, and the ability to save money by purchasing products or services online. These linkages are depicted in hypotheses 31 to 46 for the economic use to economic outcome domain.

Cultural *use* refers to how individuals engage with digital platforms and technologies to explore, share, and express cultural identities and values. This includes using the internet to learn about one's heritage, connect with others with similar cultural backgrounds, or participate in cultural activities like arts, music, and traditions. It also involves accessing and spreading information that fosters understanding of different cultural perspectives, shaping how people see themselves and others within broader societal frameworks. These linkages are depicted in hypotheses 15 to 16 for social skills to cultural use and hypotheses 23 to 24 for creative skills.

A cultural *outcome* refers to how individuals connect with their identity, beliefs, and group norms, often influenced by their interactions with information and people. When people achieve cultural outcomes, they feel a stronger sense of belonging to specific groups, whether based on shared interests, ethnicity, religion, or gender. These outcomes reflect how online experiences shape one's understanding of social norms and identities, offering insights into how the Internet can influence belonging and identity. These linkages are depicted in hypotheses 47 to 50 for cultural use in the cultural outcome domain.

Social *use* is how individuals utilize digital tools, especially the internet, to connect, interact, and build relationships with others. This includes social networking, communicating with friends and family, participating in online communities, and engaging in civic or political discussions. Social use enhances personal and professional relationships by enabling easier, faster, and more frequent interactions across various social contexts. These linkages are depicted in hypotheses 17 to 19 for social skills and hypotheses 25 to 27 for creative skills to social use.

Social *outcomes* refer to the benefits individuals derive from improved relationships, networks, and interactions due to internet use. These outcomes can include strengthened personal bonds with friends and family (formal networks), enhanced civic participation through joining organizations (informal networks), or increased political engagement via better communication with representatives (political networks). These outcomes humanize online activities by fostering a deeper connection to one's social environment, creating personal fulfillment and broader community ties. These linkages are depicted in hypotheses 51 to 59 for social use to social outcome domain.

Personal *use* refers to how individuals engage with digital technologies, such as the Internet, to enhance their well-being and leisure activities. This may include using online resources for health and fitness, self-improvement, entertainment, or hobbies. Personal use focuses on activities that contribute to an individual's sense of fulfillment, such as gaining knowledge, engaging in creative projects, or improving lifestyle choices, all of which support their personal growth and satisfaction. These linkages are depicted in hypotheses 20 to 22 for social skills for personal use and hypotheses 29 to 30 for creative skills to personal use domain.

Personal *outcomes* are the tangible benefits individuals experience in various aspects of their lives, including health, lifestyle, leisure, and self-actualization. These outcomes often manifest as improvements in well-being, such as enhanced fitness, better decision-making about health, or increased happiness from leisure activities. Personal outcomes are about fulfilling one's potential, leading to a deeper sense of satisfaction with life. They may stem from using information or resources, such as online health advice or lifestyle choices, which help individuals feel more confident and empowered in their daily decisions. These linkages are depicted in hypotheses 60 to 68 for personal skills to personal outcome.

This framework also acknowledges the role of demographic and contextual variables such as age, educational background, institutional type (public or private), and geographic location (near or within city centers) in shaping digital inequalities. These factors are considered potential moderators that may influence the relationship between internet skills and outcomes. For example, age may moderate the relationship between creative skills and professional outcomes, as older educational workers might be less familiar with digital content creation than younger students. Similarly, the type of institution (public or private) and regional disparities in internet infrastructure may affect participants' ability to develop and use their internet skills effectively.

To test these hypotheses, the study employs Partial Least Squares Structural Equation Modeling (PLS-SEM), which is well-suited for analyzing complex relationships between multiple constructs. Multigroup Analysis (MGA) compares how these relationships differ between students and educational workers, allowing for a detailed examination of how digital inequalities impact these groups differently. The conceptual framework provides the foundation for identifying the key digital skills contributing to disparities in educational and professional outcomes. By analyzing these relationships, the study aims to offer insights into the second-level and third-level digital divides and propose targeted interventions to bridge these gaps in higher education settings.

Research Method

Instrumentation and Construct Measures

The measurement tool used for Internet Skill demonstrated strong reliability and validity across different dimensions. The operational skill dimension had a reliability coefficient of .84, the information-navigation dimension had a reliability coefficient of .88, the social dimension had a reliability coefficient of .87, and the creative skill dimension had a reliability coefficient of .89, indicating high internal consistency within each dimension of the Internet Skill. A 3-item measurement developed by Van Deursen et al. (2015) was employed to assess Internet Usage. It focused on tangible outcomes and educational activities, utilizing a 5-point scale (1 = never to 5 = daily; 1 = strongly disagree, 5 = strongly agree) as an interval-level measure.

The Internet Outcome scale examined outcomes in four domains directly resulting from specific online usage. Additionally, a 7-item scale was used to explore the relationship between internet use and outcomes, employing a 6-point agreement scale (ranging from 1 = strongly disagree to 5 = strongly agree, 0 = never engaged) as an interval-level measure. The reliability and validity of the questionnaire were evaluated through several methods. Pilot tests and cognitive interviews were conducted in the UK and the Netherlands to assess the clarity and understanding of the tangible outcome items across economic, social, cultural, and personal fields. The report highlights that the reliability of the questionnaire was generally supported, mainly for economic and social outcomes. Still, some challenges were noted in measuring cultural and personal outcomes due to the abstract nature of these fields. This reflects a solid attempt to ensure that the questionnaire reliably captures outcomes, but further refinement was recommended for some areas, especially for cultural variables (Helsper et al., 2015).

Sampling

The participants were selected through convenience sampling, focusing on educational institutions in city centers in the Philippines' Northern and Southern regions. The assumption is that if digital deprivations are manifested in urban centers, they will be more pronounced in rural areas (World Bank 2020, 2024). The sample includes educators from public and private schools, particularly those where the authors are affiliated. This approach allowed the authors to gather data from readily accessible and willing participants across diverse educational settings. While efforts were made to include a variety of contexts, it is essential to note that the sample may not be strictly proportional or statistically representative of the entire Philippine education system. However, this method still enabled the study to capture a range of perspectives and experiences, providing valuable insights into digital inequalities across different educational environments.

The survey was conducted online from April to June of the academic year 2022-2023, and 1,360 participants were involved in the study, including 782 students and 378 educational workers from various private and public higher educational institutions. Data cleaning procedures resulted in a reduction of the sample size to 1,160 valid responses (see Table 1). Students aged 18-25 were included, representing both undergraduate and graduate levels. Educational workers were selected based on their teaching, administrative tasks, or IT support roles within the HEIs. Efforts were made to include a balanced representation of both genders and various age groups to assess whether digital inequalities differ across these demographics.

Table 1: Demographic profile

	Educational Worker	Non-educational worker
Age group		
19 years old and below	4	197
20-30 years old	108	557
31-45 years old	165	27
46-60 years old	90	1
60 years old and above	11	0
School Type		
Private Owned	223	722
Public/Government	155	60
Hours spent online		
<4 hours	94	193
4-8 hours	182	411
> 8 hours	102	178
Location		
Southern PH	166	782
Northern PH	212	0

Statistical Analysis

The complexity of the model structure drives the rationale for choosing PLS-SEM. The conceptual framework posits multiple relationships between internet skills (information-navigation, social, and creative) and various educational and professional outcomes, as depicted in Figure 2. PLS-SEM is well-suited for analyzing complex path models with multiple constructs and indicator variables (Hair et al., 2019). It is also more flexible regarding sample size and data distribution assumptions than covariance-based SEM. This flexibility is beneficial given the specific sample from selected HEIs in the Philippines. Our model includes formative (e.g., internet skills) and reflective (e.g., some outcome measures) constructs. PLS-SEM can effectively handle both measurement models within the same analysis (Hair et al., 2019). While our study is grounded in established theories (Van Deursen et al., 2015; Helsper et al., 2015), the specific context of Philippine higher education introduces an exploratory element. PLS-SEM's ability to handle confirmatory and exploratory research is advantageous in this case (Sarstedt et al., 2016).

PLS-SEM was employed to examine the connections between Internet Skills, Usage, and Outcome variables in the proposed relationships using SmartPLS 4 for conducting t-tests, correlation analysis, path analysis, and evaluating the equation model (Ringle et al., 2022). The model comprises 28 latent constructs with 82 indicators, which may consider the model complex. Aside from G*Power, post hoc analysis was done to assess the power adequacy of the sample size using the method and formula developed by Kock and Hadaya (2018) in WarpPLS. Following Ghazali et al. (2020), the largest path coefficient (0.60) is fed into the equation with the power level required value of 0.800, resulting in 18 minimum required sample sizes for the inverse-square root method and 11 minimum required sample sizes for the gamma exponential method. The study's sample size adequacy was assessed using two methods: the inverse-square root and the gamma exponential method. Given the minimum absolute significant path coefficient in the model (-0.20) and the required power level of 0.800, the calculations yielded minimum required sample sizes of 155 and 142 for the inverse-square root and gamma exponential methods, respectively. These results prove that the collected samples are suitable and adequate for robust data analysis (Ghazali et al., 2020).

The research question explicitly calls for a comparison between students and educational workers. MGA allows us to statistically test for significant differences in path coefficients between these two groups (Sarstedt et al., 2016). By comparing model relationships across groups, MGA helps us uncover contextual factors that may influence the relationship between internet skills and outcomes. This aligns with our goal of providing targeted insights for different stakeholders in higher education (Henseler et al., 2015). Subsequently, the ability to identify significant differences between students and educational workers can inform more nuanced policy recommendations; addressing the specific needs of each group in bridging digital inequalities provides the rationale for employing MGA.

Although combining students and educational workers within the same sample could introduce potential distortions due to differences in age, role, and internet usage patterns, this challenge was addressed through MGA, which separates and analyzes the two groups independently to account for their distinct characteristics. By using MGA, the study avoids the risk of oversimplification if the groups were treated as a homogeneous population. The differences between the groups are central to the research, as the goal is to explore how digital inequalities affect these two groups differently (Cheah et al., 2020). Therefore, the results will be reported separately for each group, ensuring that the findings remain accurate and reflect the distinct digital realities faced by students and educational workers.

Measurement Invariance of Composite Models

Research on the digital divide often assumes that data in empirical research stems from a single homogenous population, which has failed to assess whether there are significant differences across two or more subgroups in the data. The MGA approach is utilized so that group-related differences in the different model estimates are reported. Following the steps and guidelines in Cheah et al. (2020), a test for measurement invariance is conducted after group generation. Invariance refers to the degree to which the relationships or parameters of a model hold across different groups or conditions. Invariance is the property of consistency or stability of the underlying structure or relationships being examined. In comparative studies or multi-group analysis, invariance is an essential assumption that ensures the validity and reliability of the results.

Measurement invariance of composite models (MICOM) is a vital step in MGA, especially when using PLS-SEM, to ensure that any observed differences between groups are genuine, not artifacts of measurement differences. The procedure in MICOM is done in SmartPLS via Permutation multigroup analysis with a one-tailed test type. In step 2 of MICOM, the resulting values confirmed the compositional invariance, meaning that a partial measurement invariance will be performed where the standardized path coefficients can be compared across groups. Using Bootstrap MGA, the measurement model (factor loadings, indicator reliability, and convergent and discriminant validity assessments) was tested first, followed by the testing of the structural model (path coefficients, significance levels, and indirect or total effects) using check values specified in Hair et al. (2019).

Results and Discussions

The relationship of the different Internet Skills (operational skills, information-navigation skills, social skills, and creative skills) that serve as antecedents to the examination of Internet Usage for the different domains (capital, cultural, social, personal) and the various Outcomes for each domain are revealed with the analysis and comparison of the significant structural paths for both groups (educational workers and students).

Reliability and Validity Analysis

An evaluation was conducted to verify the reliability of the measurement model and ensure that the observed indicators effectively measured their corresponding unobservable latent constructs. This assessment focused on the consistency between the observed indicators and the underlying latent variables (LV). Composite reliability (CR) and average variance extracted (AVE) were examined to determine the internal consistency and convergent validity. The CR for each LV is at least 0.881, supporting the internal consistency of the indicators. The AVE for both models was also substantially above the necessary 0.5 threshold. Indicators with outer loadings between 0.4 and 0.7 are removed. The discriminant validity was assessed using the heterotrait-monotrait (HTMT) ratio of correlation fixed cut-offs and inferential tests (Henseler et al., 2015) using the cut-off value of 0.9. Every HTMT value for every construct is below the cut-off value, adhering to Ringle et al. (2018) note that a bootstrapping procedure is used to determine whether the HTMT value is statistically significantly lower than one.

Structural Model and Hypothesis Result

A subsample of 5000 is set in the bootstrapping process to validate the inner model in testing the hypotheses (Hair et al., 2011). The significance of each path coefficient is accepted if the t-value is greater than 1.95. Before testing the structural model, fit adjustment with standardized root mean square residual (SRMR) value was evaluated. The result in Table 2 (SRMR=0.047, Chi-Square = 4745 (Group1); Chi-Square = 8024 (Group2) indicates a good fit adjustment since a value less than 0.10 or of 0.08 for SRMR is considered a good fit (Hu & Bentler, 1999; Henseler et al., 2014).

Table 2: SRMR Between Group

	Education Worker		Student	
	Saturated model	Estimated model	Saturated model	Estimated model
SRMR	0.047	0.183	0.047	0.198
d_ULS	4.175	63.337	4.107	74.080
d_G	1.987	3.392	1.527	2.983
Chi-square	4745.432	6837.284	8024.917	13119.183
NFI	0.656	0.504	0.726	0.551

Figures 3 & 4 include the results of the structural model assessment showing the path coefficients, P-value, and T-value for each path following the hypothesized relationship. The MGA results are presented using the permutation test (Chin et al., 2016) and Henseler's bootstrap-based MGA method (Henseler et al., 2015). Henseler's MGA technique uses a significance level of 5%, where a p-value smaller than 0.05 or greater than 0.95 indicates a significant difference in group-specific path coefficients. Hypothesis testing using 5,000 permutations reveals substantial differences between the two groups.

First Level

Figures 3 and 4 illustrate the six hypothesized relationships (H1 through H6) of Internet Skills at the first level. These figures present an analysis of the path coefficient differences, utilizing Henseler's MGA and permutation p-values based on a one-tailed test. This comprehensive approach allows for a rigorous examination of the proposed relationships within the Internet Skills framework, providing insights into each hypothesized connection's statistical significance and comparative strength.

For H1, the path coefficient difference of -0.11 suggests a difference in the relationship between the variables for Group 1 (educational workers) compared to Group 2 (students). However, both Henseler's MGA ($p > 0.05$) and the permutation test ($p > 0.05$) indicate that there is no significant difference in the group-specific path coefficients between the two groups. The same interpretation for H2 (-0.056; p=0.80; p=0.18), H3 (0.05; p=0.80; p=0.18), H5 (-0.06; p=0.81; p=0.22), and H6 (-0.04; p=0.70; p=0.32). For H4, the results indicate a significant difference between Group 1 and Group 2 in terms of the path coefficients. Group 1 has a lower path coefficient than Group 2, suggesting a weaker relationship between the variables for Group 1. This difference is supported by the non-overlapping confidence intervals and p-values from Henseler's MGA (p = 0.99) and the permutation test (p = 0.00). These findings highlight the distinct nature of the relationships between the variables for each group, implying that digital inequalities exist at level one.

The analysis reveals a complex interplay of relationships among the variables, demonstrating both positive and negative correlations. Hypothesis 2 (H2) stands out as having a strong and highly significant relationship. Hypotheses 6 (H6) and 3 (H3) exhibit moderate relationships, while Hypotheses 1 (H1), 4 (H4), and 5 (H5) indicate relatively weaker associations. Notably, the results suggest a significant association between operational skills and social skills, with the latter also showing a moderate but significant relationship with creative skills. These findings provide a nuanced understanding of the interconnections between various skill sets within the Internet Skills framework.

Second Level

The second-level relationship stems from social skills (SOCSKL) and creative skills (CREASKL) to the different internet use variables that comprise the use of the internet for capital, cultural, social, and personal domains in hypotheses 7 to 30. For H8, the path coefficient difference of 0.14 indicates a significant difference in the relationship between the variables of interest for Group 1 and Group 2. Both Henseler's MGA ($p < 0.05$) and the permutation test ($p < 0.05$) confirm the significant difference in the group-specific path coefficients between the two groups. The same holds for H9 (0.14; p=0.03; p=0.03), H12 (0.13; p=0.03; p=0.04), H28 (0.22; p=0.00; p=0.01), and H29 (0.14; p=0.03; p=0.03) manifesting significant difference in the relationship between the variables of interest for Group 1 compared to Group 2. Both Henseler's MGA and the permutation test show that there is no significant difference in the group-specific path coefficients between the two groups in the relationships examined in H7, H10, H11, H13, H15, H16, H17, H18, H19, H20, H21, H22, H23, H24, H25, H26, H27, and H30. The results indicate meaningful connections between social and creative skills and the four domain variables. The findings reveal that both groups use creative skills in the four domains. However, the social skills of educational workers (Group 1) are primarily limitedly associated with finance use and leisure use. In contrast, for students (Group 2), social skills have significant relationships with use for the economic domain (property, finance, employment), social (formal networks, political), and personal (self-actualization and leisure). Digital natives, particularly young adults, are known for their proficiency in using digital tools such as instant messaging, chatting, and engaging in entertainment and leisure activities like downloading music or casual web browsing (van Deursen et al., 2011).

Research suggests that education shapes internet usage patterns (Robinson et al., 2015; Van Dijk, 2005). Higher levels of education are associated with using the Internet for health information, financial transactions, and research (Howard et al., 2001; Van Djik, 2013). Considering that educational workers generally have higher educational status compared to students, the results of this study align with Quimba et al.'s (2020) assertion that the older group may have less motivation to establish personal and social identities, as their social skills are mainly related to finance and leisure use. Regarding access, studies theorized that closing digital divides may be possible, but there are marked inequalities in people's capability to use digital resources (Vassilakopoulou1 & Hustad, 2021).

Third Level

The third-level relationships (H31 to H68) explore the connection from economic, cultural, social, and personal domains to the different outcome constructs. This relationship was examined in the 38 proposed relationships between Group 1 and Group 2. For H43, the path coefficient difference of 0.13 indicates a significant difference in the relationship between the variables of interest for Group 1 and Group 2. For example, while both groups use education for outcome education, educational workers use education for acquiring property and improving employment. Both Henseler's MGA ($p < 0.02$) and the permutation test ($p < 0.01$) confirm the significant difference in the group-specific path coefficients between the two groups. The same interpretation is used for H44 (0.14; p=0.02; p=0.01), H45 (0.28; p=0.00; p=0.00), and H46 (0.18; p=0.00; p=0.01) manifesting significant differences in the relationship between the variables of interest for Group 1 and Group 2. For H42 and H64, the results indicate a significant difference between Group 1 and Group 2 regarding the path coefficients. Group 1 has a lower path coefficient than Group 2, suggesting a weaker relationship between the variables for Group 1. This difference is supported by the non-overlapping confidence intervals and p-values from both Henseler's MGA ($p = 0.97$ for H42; $p = 0.96$ for H64) and the permutation test ($p = 0.04$ for H42 and $p = 0.03$ for H64). These findings highlight the distinct nature of the relationships between the variables for each group. Both Henseler's MGA and the permutation test shows that there is no significant difference in the group-specific path coefficients between the two groups in the relationships examined in H31, H32, H33, H34, H35, H36, H37, H38, H39, H40, H41, H47, H48, H49, H50, H51, H52, H53, H54, H55, H56, H57, H58, H59, H60, H61, H62, H63, H65, H66, H67 and H68.

Although combining students and educational workers within the same sample could introduce potential distortions due to differences in age, role, and internet usage patterns, this challenge was addressed through MGA, which separates and analyzes the two groups independently to account for their distinct characteristics. Using MGA, the study avoids the risk of oversimplification if the groups were treated as a homogeneous population. As mentioned earlier, the MGA approach reports group-related differences in model estimates. After generating the groups, measurement invariance testing was conducted following the steps and guidelines outlined by Cheah et al. (2020). In comparative studies or multi-group analysis, invariance is an essential assumption that ensures the validity and reliability of the results. The differences between the groups are central to the research, as the goal is to explore how digital inequalities affect these two groups differently. Thus, the results were reported separately for each group, ensuring that the findings remain accurate and reflect the distinct digital realities faced by students and educational workers.

Summary of Findings for Educational Workers

The PLS-SEM and MGA analysis for educational workers (Group 1) reveals distinct Internet Skills, Usage, and Outcomes patterns. The model demonstrates good reliability, validity, and fit, with an SRMR value of 0.047 and a Chi-Square of 4745.

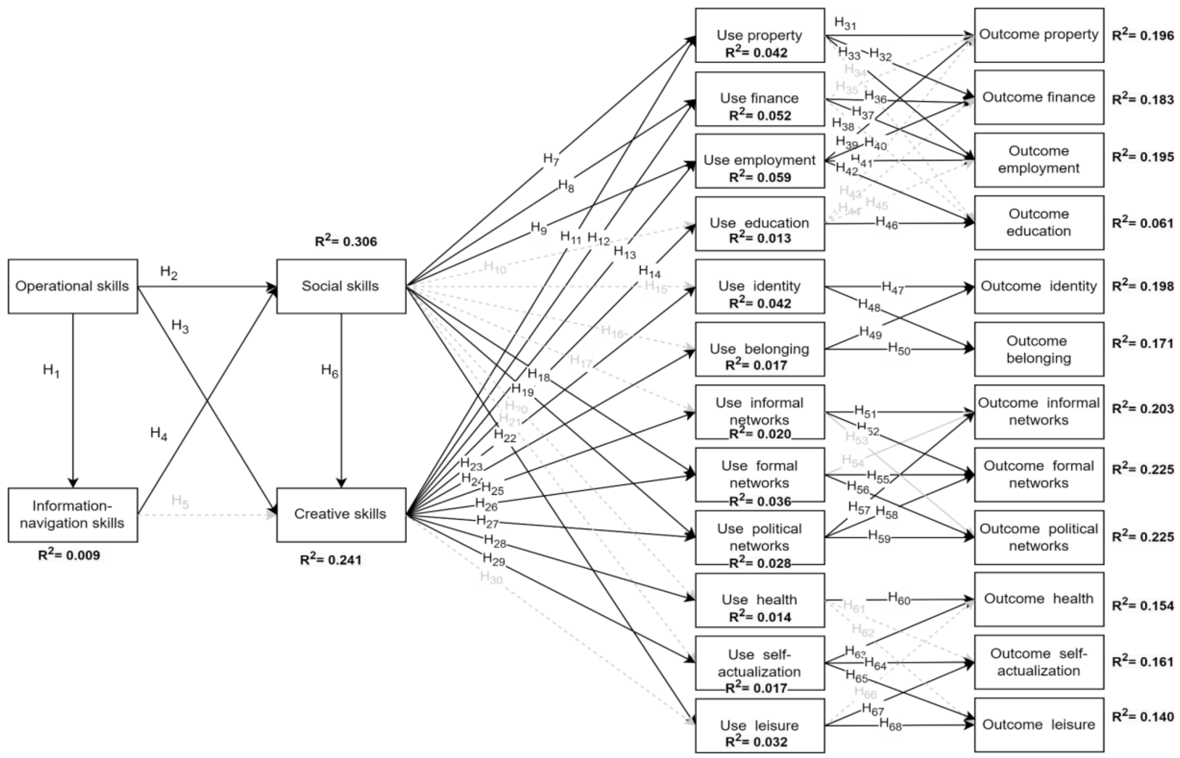

Figure 3: Significant Structural Paths (Group 1: Educational Worker)

As presented in Figure 3, in terms of Internet Skills, educational workers show a weaker relationship between operational skills and information-navigation skills compared to students. Their Internet Use patterns are more focused, with social skills primarily associated with finance and leisure use. This contrasts with students' broader application of social skills across various domains. Like students, creative skills are utilized across all four domains (economic, cultural, social, and personal). However, educational workers demonstrate stronger relationships in leveraging educational internet use for economic outcomes, including property, finance, employment, and income.

The analysis suggests that educational workers, who generally have higher educational status, may be more adept at translating their internet skills and educational resources into tangible economic benefits. This aligns with previous research indicating that higher levels of education are associated with using the Internet for health information, financial transactions, and research.

Summary of Findings for Students

The PLS-SEM and MGA analysis for students (Group 2) reveals several significant findings across the three levels of Internet Skills, Internet Use, and Outcomes. The model demonstrates good reliability and validity, with CR values of at least 0.881 and AVE values above the 0.5 threshold. Discriminant validity is confirmed using the HTMT ratio, with all values below the 0.9 cut-off. The model also shows a good fit with an SRMR value of 0.047 and a Chi-Square of 8024 for the student group.

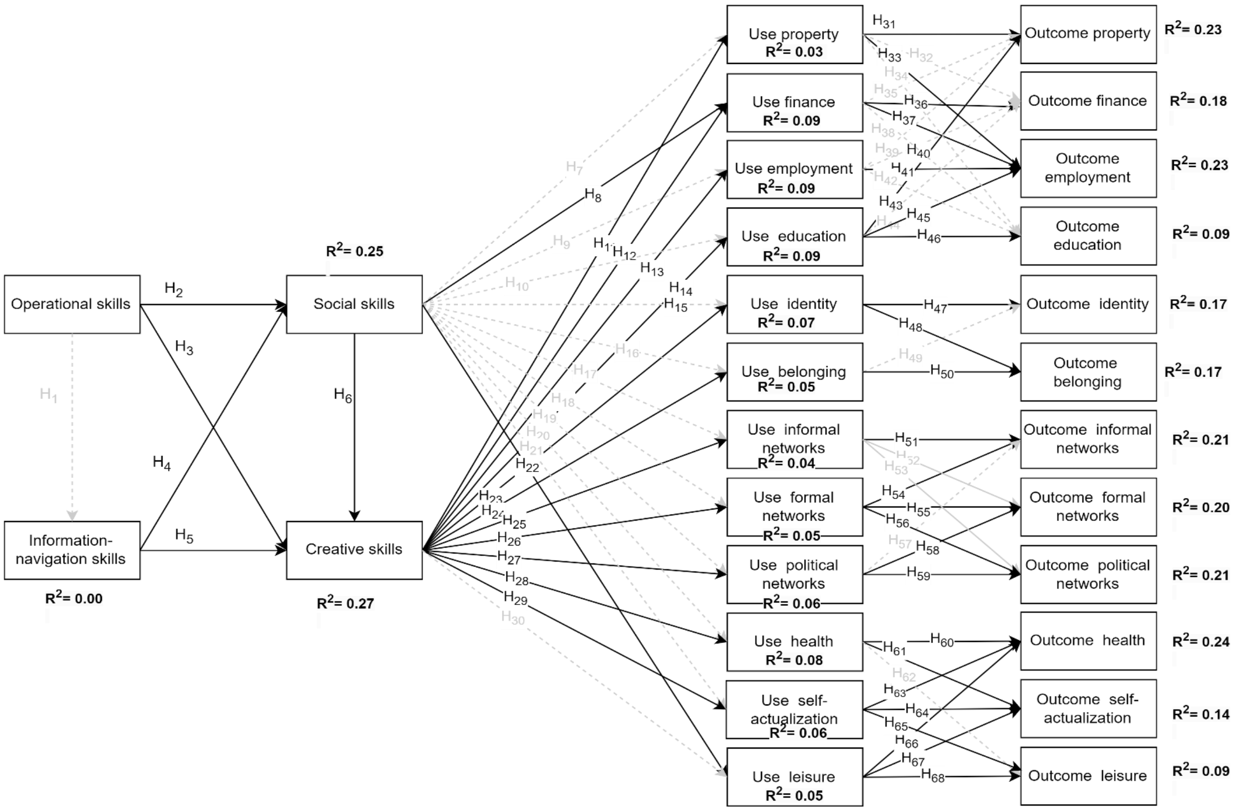

Figure 4: Significant Structural Paths (Group 2: Students)

At the first level, focusing on Internet Skills, students exhibit a significantly more robust relationship between operational and information-navigation skills than educational workers (Group 1). This suggests students have a more integrated approach to basic internet operations and information searching.

The second level, examining Internet Use, highlights that students' social skills are significantly associated with various internet uses. These include economic domain use (property, finance, employment), social domain use (formal networks, political), and personal domain use (self-actualization, leisure). Creative skills are utilized across all four domains (economic, cultural, social, and personal). Notably, there are significant differences between students and educational workers in how social and creative skills relate to various domains of internet use, particularly in cultural, social, and personal areas.

The third level, focusing on Outcomes, reveals interesting patterns. Students show stronger relationships in using education-related internet resources for educational outcomes and leisure-related resources for personal income outcomes. However, compared to educational workers, students demonstrate weaker relationships in leveraging educational internet use for economic outcomes such as property, finance, employment, and income.

As summarized in Figure 4, these findings suggest that while students are proficient in using digital tools for various purposes, including communication, entertainment, and leisure activities, they may need to be more adept at translating their educational internet use into tangible economic benefits. This could indicate a digital inequality in how different groups utilize internet skills and resources for various outcomes.

Group Comparisons

The PLS-SEM and MGA results reveal significant differences between educational workers (Group 1) and students (Group 2) in their internet skills, usage, and outcomes. Students demonstrate a more integrative approach to operational and information-navigation skills, while educational workers show a more compartmentalized approach. In terms of social skills application, students apply these broadly across economic, social, and personal domains, whereas educational workers use them more narrowly, primarily for finance and leisure. Both groups utilize creative skills across all domains, but students show more substantial relationships with social and personal domain use, especially for self-actualization and leisure. Regarding outcomes, while students effectively use educational resources for educational purposes, educational workers are more adept at leveraging these resources for economic outcomes such as property acquisition, finance management, employment, and income generation.

Overall, students exhibit a more versatile and broad application of internet skills, especially social skills. At the same time, educational workers demonstrate a more focused, outcome-oriented approach, particularly for professional and economic purposes. These differences highlight the digital inequalities between the two groups, with students excelling in diverse applications but lagging in economic translations. At the same time, educational workers show more targeted use, leading to more substantial economic outcomes. This comparison underscores the complex nature of digital skills and their applications across different demographic groups.

Implications and Recommendations

The results of this PLS-SEM and MGA analysis comparing educational workers and students have significant implications for digital literacy programs, educational policies, and workforce development initiatives. The findings suggest a need for tailored approaches to bridge digital divides and enhance digital skills across different demographic groups. For students, programs that help translate their diverse internet skills into tangible economic outcomes must be developed. This could involve incorporating more real-world, economically focused digital tasks into the curriculum, such as financial management tools, job search strategies, and professional networking platforms. Educational institutions should consider partnering with industries to allow students to apply their digital skills in professional contexts, potentially through internships or project-based learning.

For educational workers, the focus should be on broadening their application of social and creative digital skills beyond finance and leisure. Professional development programs could emphasize using social media and collaborative digital tools for networking, knowledge sharing, and creative problem-solving in educational settings. Both groups would benefit from targeted training in emerging technologies and their applications across various domains. Policymakers should consider these digital inequalities when designing initiatives to promote digital inclusion. This might involve creating differentiated digital literacy programs that address the specific needs of each group. For students, this could mean emphasizing the economic applications of their digital skills, while for educational workers, it could focus on diversifying their digital skill set.

Employers and workforce development agencies should consider these differences when designing job training programs or assessing digital competencies. They might consider implementing mentorship programs where educational workers can share their expertise in leveraging digital skills for economic outcomes. At the same time, students could offer insights into more diverse and social applications of digital technologies.

Limitations

This study has several limitations that should be considered when interpreting the results. First, while allowing for diverse participants, the convenience sampling method may not fully represent the entire Philippine higher education landscape. While based on sound assumptions, the focus on urban centers may not capture the full spectrum of digital experiences across the country. Second, the diversity within the student and educational worker groups (e.g., undergraduate vs. graduate students, different roles of educational workers) may introduce variability that is not fully accounted for in the analysis. While MGA helps address some of these differences, future studies could benefit from more granular analyses of subgroups. Lastly, the study's cross-sectional nature limits our ability to draw causal conclusions about the relationships between internet skills, usage, and outcomes. Longitudinal studies could provide more robust evidence of how these factors influence each other over time.

Theoretical Implications and Comparison with Existing Literature

This study's findings contribute to the ongoing discourse on digital inequality, particularly in the context of higher education. Our results both support and extend several key theories and previous studies in this field:

> ***Van Dijk's Resources and Appropriation Theory:*** Our findings align with van Dijk's (2005) Resources and Appropriation Theory, which posits that digital inequalities are rooted in the unequal distribution of resources necessary for technology access and use. However, our study

extends this theory by demonstrating that significant differences in internet skills and their application persist even within groups with similar access levels (students and educational workers in higher education institutions). This supports van Dijk's assertion that closing the access gap alone cannot address digital inequalities.

Second-Level Digital Divide: Our results provide empirical support for Hargittai's (2008) concept of the "second-level digital divide," which focuses on inequalities in skills and usage patterns rather than mere access. The observed differences between students and educational workers in their proficiency with various internet skills (information-seeking, social, and creative) demonstrate that digital inequalities persist even when access is relatively uniform. This underscores the importance of skill-focused interventions in addressing digital inequalities.

Digital Capital Theory: Our findings contribute to the emerging theory of digital capital (Ragnedda, 2018) by demonstrating how different internet skills translate into varied outcomes across economic, cultural, social, and personal domains. The observed differences between students and educational workers in leveraging their skills for tangible outcomes support the idea that digital capital is not uniformly distributed or utilized, even within seemingly homogeneous groups.

Generational Differences in Digital Skills: Our results support and challenge prevailing notions about generational differences in digital skills. While students demonstrated higher proficiency in creative and social internet skills, aligning with theories about "digital natives" (Prensky, 2001, p.1), their lower information-seeking skills contradict the assumption that younger generations are universally more adept with digital technologies. This nuanced finding contributes to a more complex understanding of generational differences in digital competencies.

Context-Specific Digital Inequalities: Our study extends previous research on digital inequalities in developing countries (e.g., Tayo et al., 2016; Quimba et al., 2020) by providing a detailed analysis of skill differences within the Philippine higher education context. The findings highlight the importance of considering local contexts when studying digital inequalities, as patterns may differ from those observed in more developed economies.

Tangible Outcomes of Internet Skills: Building on Helsper et al.'s (2015) work on tangible outcomes of internet use, our study provides empirical evidence of how different internet skills translate into varied outcomes for students and educational workers. This contributes to a more nuanced understanding of the relationship between digital skills and real-world benefits, highlighting the need for targeted skill development to maximize positive outcomes.

Intersectionality in Digital Inequality: Our findings support the growing literature on intersectionality in digital inequality (Robinson et al., 2015; Robinson et al., 2020) by demonstrating how the educational role (student vs. worker) intersects digital skills to produce varied outcomes. This underscores the importance of considering multiple factors when examining and addressing digital inequalities.

Finally, this study corroborates and extends existing theories on digital inequality by providing nuanced insights into skill differences and their outcomes within the specific context of Philippine higher education. Our findings highlight the complex nature of digital inequalities, demonstrating that they persist even in environments with relatively uniform access. They also emphasize the need for targeted interventions that address specific skill deficits and their applications across domains.

Conclusion

This study provides significant insights into digital inequalities and internet skill utilization among educational workers and students in selected HEIs in the Philippines. The research reveals a nuanced picture of digital inequality: students demonstrate more diverse and integrated internet skills, particularly in social and creative domains, while educational workers excel in translating their digital skills into tangible economic outcomes. These findings challenge simplistic notions of digital divides based solely on access or basic skills, emphasizing the importance of skill application and outcomes.

The study extends existing frameworks of digital inequality, such as van Dijk's resources and appropriation theory, by providing empirical evidence on how different internet skills (operational, information-navigation, social, and creative) translate into varied usage patterns and outcomes across groups. It contributes to developing a more comprehensive theory of digital capital, demonstrating how different internet skills and usage aspects contribute to economic, cultural, social, and personal domains. This study also offers a robust foundation for future research and for developing more sophisticated, context-sensitive models of digital inequality, thus contributing significantly to the field's empirical and theoretical dimensions.

Methodologically, the research showcases the effectiveness of combining PLS-SEM with MGA in capturing and analyzing complex, multi-level relationships in digital skill utilization. These insights fulfill the study's aims of examining digital disparities and their implications, advancing the theoretical landscape of digital literacy studies.

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