DIGITAL SKILLS AND DIGITAL CITIZENSHIP EDUCATION: AN ANALYSIS BASED ON STRUCTURAL EQUATION MODELING

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Abstract

The main objective of this study is to examine the correlation between digital skills and their correlation with digital citizenship among students enrolled at a university in Peru. The research was carried out using a sample of 906 participants, encompassing individuals of various genders, with ages spanning from 17 to 54 years. The methodology of choice aligns with a non-experimental, cross-sectional, descriptive-explanatory design. The findings of this study indicate that the development of participation skills, whether in traditional face-to-face settings or in online digital platforms, significantly influences the formation of digital citizenship. The aforementioned observation holds considerable ramifications for the field of digital skills education, underscoring the imperative to prioritize and actively advocate for the development of participation skills in the context of the digital age. The importance of digital skills in our contemporary society is widely acknowledged. However, the connection between digital skills and digital citizenship is intricate and complex.

Keywords – Digital citizenship, Offline and online skills, Online inquiry, PLS-SEM (Partial Least Squares Structural Equation Modeling).

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1. Introduction

In the contemporary digital era, the constant flow of information, online interactions, and the widespread use of technological devices has fundamentally transformed the manner in which individuals establish connections with the world around them. The impact of the digital world on society is undeniably significant, including multiple spheres such as personal communication, learning, work, and entertainment (Aguado, 2020). inside this particular setting, the notion of Digital Citizenship arises, including the

requisite abilities, proficiencies, and conduct essential for proficient and ethical engagement Inside the digital realm. The early manifestations of digital citizenship placed significant emphasis on the significance of technology and information accessibility (Torres-Gastelú, Cordero-Guzmán, Soto-Ortiz & Mory-Alvarado, 2019).

In the current context, characterized by rapid technological advancements and the expansion of the digital sphere, a profound reevaluation of the traditional concept of citizenship has occurred, leading to the emergence of digital citizenship. This concept encompasses a range of predictors, including demographic, individual, and psychological factors, essential for understanding the levels of digital citizenship and education among adolescents (Lu & Gu, 2024). The research conducted by Mahadir, Baharudin and Ibrahim (2021) in Malaysia highlights the significance of integrating digital citizenship education within educational systems, given the high competencies of students in this area. Concurrently, Sandoval (2019) identifies significant differences in digital citizenship perceptions among higher education students, varying by age, gender, online time, and computational skills, underscoring the need to focus educational practices on strengthening digital citizenship at the university level.

On the other hand, a meta-analysis by Gil and Armenta (2022) categorizes scientific research on digital citizenship, emphasizing the educational process as the most relevant area, while a study in Indonesia by Prasetiyo, Sari, Sa'diyah, Naidu and Prasetyo (2022) demonstrates high levels of readiness in skills and attitudes related to digital citizenship, noting differences according to demographic profiles. Additionally, Bal and Akcil (2024) develop and evaluate a digital citizenship curriculum for university students, showing significant improvements that suggest a potential for sustainable application. Collectively, these studies underscore the critical intersection between digital skills education and digital citizenship, illustrating the need for educational programs that prepare students to participate in the digital world in an informed and ethical manner.

The concept of digital citizenship has been examined and analyzed from multiple viewpoints. One commonly accepted perspective characterizes it as a collection of activities associated with political engagement in the modern era (Sierra, 2018; Candón-Mena, 2013). Alternatively, there exists a perspective that conceptualizes it as a collection of standards and ethical conduct in the utilization of Information and Communication Technologies (ICT). According to Natal, Benítez and Ortiz (2014), the prevailing viewpoint of the digital citizen characterizes them as an individual who possesses proficiency and competence in using information and communication technology (ICT) extensively in order to accomplish their objectives. Nevertheless, this particular methodology, despite its intriguing attributes, carries the potential of succumbing to techno-determinism and exhibiting a tendency to focus on the individual. In contrast, considering the use of ICT, particularly the Internet, which facilitates access to relevant data and fosters an expanding and intensification of discourse on matters of public significance, it is reasonable to suggest that the advancement of digital citizenship has the potential to promote civic engagement in matters that impact individuals, resulting in benefits for society. In the current era, marked by the widespread presence of social networks and digital platforms, an important shift has taken place in the technological realm. The prevalence of unmoderated content within virtual spaces require that users develop a comprehensive range of digital competencies. The scope of this range encompasses various cognitive and attitudinal dimensions, along with the proficiency in using digital tools and resources to identify, retrieve, navigate, assess, analyze, and integrate information. Additionally, it involves the capacity to generate knowledge, produce multimedia content, engage in communication with others, and apply critical skills within virtual environments (Richardson, Pickus & Parks, 2019). Moreover, the objective is to build productive methodologies in the digital domain (Loor-Intriago & García-Vera, 2020). Despite the inherent significance of these aspects of digital abilities, they persistently undergo transformation and adjustment in order to effectively tackle emerging complexities inside the perpetually evolving digital world.

Indeed, certain scholars have extended their analysis to uncover supplementary distinct characteristics within the realm of digital literacy. Cho, Cannon, Lopez and Li (2022) established a conceptual framework that presents six distinct dimensions of social media literacy. These dimensions include navigation,

curation, assessment, comprehension, digital creation, and interaction. The dimensions encompass a spectrum of activities, ranging from the processing of information (Knoll, Matthes & Heiss, 2018) to active participation in digital platforms. These dimensions play a crucial role in facilitating the effective and efficient retrieval of information within a saturated and occasionally misleading digital landscape. Within this particular framework, the ethical dilemma in scholarly investigation remains prevalent, as internet accessibility demonstrates an inverse relationship with instances of student plagiarism, however ethical oversight and instructional elements display a clear connection (Abbas, Fatima, Arrona-Palacios, Haruna & Hosseini, 2021).

It is imperative to acknowledge that digital citizenship extends beyond simply proficiency in accessing and managing information. According to Kim and Choi (2018), it is imperative to consider four essential areas that encompass an individual's digital citizenship: self-identity, beliefs, protection, and responsible application of the digital ecosystem. The aforementioned categories underscore the significance of not only approaching digital information from a technological position, but also, from an ethical and social perspective. Drawing upon the previously stated premises, the subsequent hypothesis is postulated:

H1: There is a statistically significant effect between efficient and effective access to information and the formation of digital citizenship

The connection between the increasing use of digital media and the growth of an engaged and mindful digital citizenship has been extensively discussed in current scholarly discourse. Gómez-Ponce and Pardo (2007) argue that the emergence of digital media has led to a noticeable divide between authorities and citizens, leading to heightened skepticism towards institutions and a decline in civic engagement on socially significant matters. Aligned with this particular viewpoint, Fajardo-Pascagaza and Serrano-Carrascal (2022) emphasize the significant influence of social networks in defining the concept of digital citizenship. They highlight that the advent of information technology and social media has brought about a transformation in how individuals perceive and engage as members of society.

Cabero-Almenara, Torres-Barzabal and Hermosilla-Rodríguez (2019) propose that ICTs have played an essential part in the development of a digital social democracy, facilitating increased opportunities for collective engagement in consequential decision-making processes. Nevertheless, it is imperative to note that in order for participation to be genuine and impactful, it is essential to possess comprehensive education that incorporates not only technology knowledge but also cultural and political understanding.

In contrast, Hunt (2023) asserts that despite the progressive development of digital literacy, its present emphasis lies predominantly on the capacity to engage with content in a critical manner and comprehend the fundamental influences that shape its development. The acquisition of digital skills serves as a crucial foundation for developing an educated and responsible digital citizen. According to Rideout (2015), adolescents, who engage extensively with digital media, are increasingly susceptible to its effect. This statement underscores the pressing necessity to offer suitable educational opportunities for the emerging generation.

Furthermore, Duncan and John (1989) as well as Erstad (2015) provide valuable insights about the development of digital skills and the necessary adjustments required in light of the emergence of digital media. Hollandsworth, Dowdy and Donovan (2011) and Hunt (2023) emphasize the significance of digital literacy in contemporary society, claiming that due to the inherent connection between media and the everyday routines of youth, it is crucial to provide them with educational resources that facilitate their participation in the digital realm. Similarly, the works of Hobbs (2010), and Schreurs and Vandenbosch (2021) share a common focus on deconstructing the fundamental elements of digital skills, encompassing activities such as information retrieval and assessment, as well as the cultivation of secure and ethical conduct within digital environments.

Consequently, the advent and widespread adoption of digital media and social networks have resulted in substantial changes in the manner in which individuals obtain information, engage in social interactions,

and actively engage in societal affairs. The acquisition of digital skills is of utmost importance in promoting an essential and engaged digital citizenship, a viewpoint that is substantiated by numerous authorities in the domain. Based on the aforementioned premises, the following hypothesis is proposed:

H2: There is a statistically significant effect between the use of new and traditional media formats in the formation of digital citizenship

Collaborative inquiry is structured as a cyclical procedure that encompasses the identification of common challenges, the implementation of collective inquiry actions, and the subsequent reflection on the outcomes as proposed for by DeLuca, Shulha, Luhanga, Shulha, Christou and Klinger (2015). According to Pino, González and Ahumada (2018), in order for this methodology to be effective, it is crucial to possess a willingness to engage in collaborative learning that is guided by principles and values that guarantee its appropriate execution.

Engaging in the process of inquiry enhances fundamental skills such as observation, systematic organization of data, articulation of hypotheses, and reflection, as supported by Contreras-Guzmán and Vásquez-Lara (2007). From a pedagogical perspective, Carrasco and Pérez (2014) underscore the instructional significance of the social sciences in developing students' information processing skills through the implementation of inquiry-based methodologies. According to Quinquer (2004), the educational paradigm requires a methodological transition from expository approaches to inquiry-based approaches, wherein the focus is on active student engagement facilitated by the teacher.

The advent of the digital era has brought about substantial changes in the dynamics of research as well. Muñoz (2007) highlights the significance of virtual ethnography as a research methodology that specifically addresses the distinct challenges and prospects posed by online communication processes. The digital changes have become notably apparent within the realm of social networks. As Pino (2010) asserts, there has been a substantial shift in media representation and the development of the principles and logic of the internet.

Drawing upon the concepts put forth by Palacios-Ramírez, Márquez Pira, Melo Prada and Serna Macías (2015 regarding the formation of contemporary youth through engagements on digital platforms such as Facebook, as well as the significance of investigating these virtual spaces, and considering the suggestion made by Gutiérrez and Artime (2017) regarding the utilization of Inquiry Communities to augment learning in social networks and their pertinence in the cultivation of digital citizenship, the ensuing hypothesis is proposed:

H3: There is a statistically significant effect between the development of skills for inquiry in networks and the formation of digital citizenship

In their study, Cicognani, Albanesi, Mazzoni, Prati and Zani (2016) examined the influence of psychosocial factors on the intentions of adolescents and young adults in Italy to engage in civic participation, both in virtual and face-to-face contexts. This approach underscores the significance of cultural circumstances and individual experiences in shaping individuals' choices pertaining to their engagement in both the digital and physical realms. In a similar manner, Morduchowicz (2022) emphasizes the significance of both types of engagement, delineating between in-person involvement, encompassing activities taking place in student centers and communities, and virtual participation. The author in question emphasizes the perception of youngsters regarding the internet as a helpful platform for engaging in social interactions.

García, Martín-Nieto and López de Ayala (2018) have examined the increasing interest in the digital realm and contend that, in the face of indifference and doubt towards conventional politics, social media has emerged as a crucial medium for rejuvenating civic and political participation. Zapatero, Brändle, San-Román and Corral (2020) focus on a particular aspect of digital activism, specifically the involvement of young individuals in expressing solidarity by signing e-petitions. The authors emphasize the persistent

presence of reasons within the realm of digital activism, while acknowledging that these motivations might differ in their nature.

Chayinska, Miranda and González (2021) and Greijdanus, de Matos-Fernandes, Turner-Zwinkels, Honari, Roos, Rosenbusch et al. (2020) underscore the proliferation of the internet and social media, highlighting the increased channels for activism. Their research reveals a positive association between online and offline protests, indicating a mutually reinforcing relationship. The interdependence between online and offline activist networks is further emphasized in the study conducted by Zhuravskaya, Petrova and Enikolopov (2020), highlighting the inherent connection between these two realms, where each can mutually influence and enhance the other. The examination of the correlation between online and offline collective action has been undertaken in a theoretical manner by Kim, Russo and Amnå (2017), who have identified a number of theoretical propositions that elucidate this interplay.

Nevertheless, it is imperative to recognize the potential obstacles under this association. Schradie (2018) identifies several challenges, including digital disparities, that may impede the integration of online and real domains. Notwithstanding these obstacles, there is substantial data that substantiates the notion of a significant and enhancing engagement between digital and in-person modes of involvement in the establishment of an educated and engaged digital citizenry. Consequently, the subsequent hypothesis is formulated:

H4: There is a statistically significant effect between the development of skills for participation in in-person and virtual environments in the formation of Digital Citizenship

The nurturing of digital skills among students is advocated as an essential instrument for fostering the growth of discerning and thoughtful digital citizens. Carrillo and Aguirre (2021) contend that the association with ICT in this particular framework ought to be grounded on critical social theory. The authors assert that digital skills are vital within educational institutions due to their ability to reveal the social, political, and cultural demands that encompass us, hence facilitating a deeper understanding of ICT as agents of knowledge. In a similar vein, Wilson, Grizzle, Tuazon, Akyempong and Cheung (2011) highlight the fact that educational establishments in underdeveloped nations are increasingly leveraging the potential of computers and educational software. The integration of technology in various sectors has led to a continuous stream of developments, hence emphasizing the need to enhance programs like digital skills. These programs have gained global acceptance as they facilitate international collaboration in the era of digitalization.

As described by Gutiérrez-Martín and Tyner (2012), the development of digital citizenship is a combination of skills that has undergone changes and has been approached in different ways throughout the years. The authors warn against oversimplifying media education by solely focusing on the acquisition of digital skills, and thereby disregarding the importance of values and attitudes. In contrast, the study conducted by Lee and So (2014) explores the correlation between media literacy and information literacy. The authors propose that although these two domains are not entirely encompassed inside one another, they do exhibit common objectives and intersect in many thematic domains. The convergence between these two disciplines presents an opportunity for productive cooperation in order to advance a novel type of literacy within knowledge-based societies.

In their recent study, Alcolea-Díaz, Reig and Mancinas-Chávez (2020) argue for the adoption of a structural approach in addressing digital education from the standpoint of Information Structure. They emphasize the importance of this approach in enabling the development of critical citizenship. This is particularly pertinent within the present situation, wherein disinformation is pervasive, and comprehending the underlying motivations and dynamics in communication is of utmost importance. Collectively, these authors substantiate the proposition that digital competencies are indispensable in the cultivation of a discerning and thoughtful digital citizenship, equipped to navigate and engage effectively in modern knowledge-based communities. Based on the aforementioned premises, the subsequent hypothesis is put forth:

H5: There is a statistically significant effect between the promotion of Media and Information Literacy (MIL) among students and the handling of the required changes in the formation of digital citizenship

2. Methodology

The study is an extension of the research initiative titled "Habilidades digitales y formación ciudadana en Perú: contexto, relevancia y perspectiva" (Digital Skills and Civic Education in Peru: Context, Significance, and Perspective) (Turpo-Gebera, Zea-Urviola, Huamaní-Portilla, Girón-Pizarro, Pérez-Zea & Aguaded-Gómez, 2023). The research aimed to evaluate the proficiency of university students in Digital Skills and Digital Citizenship, with the purpose of identifying key elements that contribute to their degree of development. The study used a non-experimental, explanatory descriptive approach, focusing on cross-sectional data collection. The instrument was administered during the period of November to December 2022. The process of selecting the sample was conducted using a random method. Table 1 displays the gender of the participants involved in the study.

	Gender	N	%	Media	DE	Minimum	Maximum
Age	Male	543	59,9%	21.36	4.50	17	54
	Female	363	40,1%	20.95	3.29	17	35
	Total	906	100,0%				

Table 1. Percentage distribution of the sample, according to age by gender

2.1. Study Sample

The age range of the participants span from 17 to 57 years, exhibiting a higher degree of variability among males in comparison to the average. The distribution of ages in the sample, in relation to percentiles, is presented as follows: P25 (1st quartile): 18.00 years. 25% of individuals are 18 years or younger; P50 (2nd quartile or median): 20.00 years. As mentioned earlier, 50% of individuals are 20 years or younger; P75 (3rd quartile): 23.00 years, and 75% of individuals are 23 years or younger.

2.2. Data Collection Instrument

The research employed a questionnaire called the "Digital Skills and Digital Citizenship" to collect data. The questionnaire included a polychoric format and a 5-point Likert scale, where respondents were asked to rate their agreement on a scale from "always" to "never" for each item. This study investigates various crucial variables, such as the Promotion of Media and Information Literacy (MIL) among students and the management of the necessary changes (Promoción de la AMI entre estudiantes y manejo de los cambios requeridos, PAMI), the Development of skills for offline and online participation (Desarrollo de habilidades para la participación offline y online, DHPPV), the Efficient and effective access to information (Acceso a la información de modo eficaz y eficiente, AIMEE), the Development of skills for inquiry in networks (Desarrollo de habilidades para la indagación en las redes, DHIR), the Application of new and traditional media formats (Aplicación de los formatos nuevos y tradicionales en los medios, AFNTM), and the Formation of Digital Citizenship (Formación de la Ciudadanía Digital, FCD). In order to establish the validity of the instrument, a combination of Exploratory Factor Analysis (Análisis Factorial Exploratorio, AFE) and Confirmatory Factor Analysis (Análisis Factorial Confirmatorio, AFC) was conducted, accompanied by the utilization of fit indices to evaluate its resilience. Following this, the research proceeded to develop the conceptual framework and identify causal relationships by formulating hypotheses.

2.3. Data Analysis Procedure

The researchers employed the Partial Least Squares Structural Equation Modeling (PLS-SEM) technique for data analysis and structuring, following the recommendation of previous studies (Hair, Ringle & Sarstedt, 2011). The selection of PLS-SEM is justified by the emerging state of research on digital

citizenship and the requirement for a methodology capable of effectively addressing the intricate interconnections among variables. PLS-SEM not only facilitates the comprehension of these interrelationships but also allows for the prediction of how specific digital skills can impact digital citizenship. Therefore, this methodology emerges as a valuable instrument for researchers and educators in this particular field, as it establishes a reliable basis for data analysis in a dynamic environment such as the variables being investigated.

3. Results

Table 2 presents a thorough evaluation of the instrument's dependability, utilizing two well-established metrics: McDonald's Omega (McDonald's ω) and Cronbach's Alpha (Cronbach's α). The McDonald's Omega coefficient, which has been proposed as a potential alternative to Cronbach's Alpha (Ventura-León & Caycho-Rodríguez, 2017), produces a point estimate of 0.911, suggesting a high level of internal consistency. The coefficient in question exhibits robustness, as evidenced by its 95% confidence interval (95% CI) ranging from 0.902 to 0.919. According to Hayes and Coutts (2020), a relatively small interval centered around 1 indicates that the actual value of McDonald's Omega would be encompassed within this range in 95% of instances. Furthermore, Cronbach's Alpha, a conventional measure used to evaluate the reliability of a test or scale, has excellent internal consistency. The point estimate for Cronbach's Alpha is 0.902, and the 95% confidence interval is from 0.894 to 0.910. The observed high values suggest that the instrument exhibits a high degree of consistency and reliability in producing results. It is important to acknowledge that both metrics demonstrate a significant level of internal consistency, hence enhancing the validity of the instrument's reliability.

Estimate	McDonald's ω	Cronbach's α
Point estimation	0.911	0.902
95% CI lower limit	0.902	0.894
Estimate	McDonald's ω	Cronbach's α
95% CI upper limit	0.919	0.910

Table 2. Reliability Statistics

During the implementation of Exploratory Factor Analysis (EFA), multiple criteria pertaining to quality and validity were employed. The oblique rotation method employed for the rotation of the components is Oblimin, also known as Weighted Oblimin. This approach is especially advantageous in situations when the variables demonstrate a significant degree of intercorrelation (Lorenzo-Seva, 2000). A set of six factors was identified using a manual criterion, whereby items with factor loadings over the threshold of 0.38 were selected. The Kaiser-Meyer-Olkin (KMO) test was employed as an initial measure to assess the appropriateness of the items in relation to their respective components. The obtained result of 0.885 indicates an appropriate level of adequacy.

Table 3 presents a comprehensive analysis of the factor loadings, which illustrate the connections between the items and the implicit factors. A factor loading with a high value signifies a robust correlation between the item and a particular factor. In relation to individual variables:

- Regarding the PAMI variable, it is seen that items PAMI1 to PAMI4 demonstrate noteworthy factor loadings, primarily in Factor 4.

- The items DHPPV2 to DHPPV4 have strong factor loadings on Factor 1, suggesting a significant association with this particular factor.

- The FCD items, namely FCD1 to FCD4, are primarily associated with Factor 2, indicating that they assess a comparable underlying concept represented by Factor 2.

- The factor loadings in Factor 3, as demonstrated by AIMEE1 to AIMEE4, exhibit significant associations with the content or underlying construct of this particular factor, indicating a close relationship.

- The components AFNTM2 to AFNTM4 in the AFNTM variable have a strong correlation with Factor 5.

- Ultimately, within the context of the DHIR analysis, it is observed that items DHIR1 to DHIR4 exhibit prominent factor loadings specifically on Factor 6.

The "Uniqueness" column quantifies the proportion of variability exhibited by each item that is distinct from the variability observed in the other items. The concept of uniqueness, also known as "residual communality," measures the extent to which the variability of a certain object is not explained by the specified causes. Put simply, it denotes the extent to which the variability of the item is not accounted for by the shared components in the factor analysis. Elevated levels of uniqueness indicate that a significant portion of the item's variability remains unaccounted for by the elements that are commonly shared. This observation implies that the item exhibits distinct qualities that are not easily aligned with the established set of defined variables. On the contrary, lower values indicate that a significant portion of the item's variability can be accounted for by the variables, hence demonstrating a strong alignment between the item and these factors.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Uniqueness
PAMI1				0.493			0.481
PAMI2				0.445	0.458		0.329
PAMI3				0.799			0.353
PAMI4				0.772			0.279
DHPPV2	0.772						0.239
DHPPV3	0.934						0.196
DHPPV4	0.897						0.143
FCD1		0.710					0.369
FCD2		0.551					0.363
FCD3		0.798					0.335
FCD4		0.728					0.442
AIMEE1			0.834				0.301
AIMEE2			0.732				0.414
AIMEE3			0.686				0.518
AIMEE4			0.925				0.144
AFNTM2					0.417		0.525
AFNTM3					0.713		0.424
AFNTM4					0.647		0.320
DHIR1						0.458	0.469
DHIR2						0.394	0.313
DHIR3						0.606	0.393
DHIR4						0.517	0.357

Note. The rotation method applied oblimin

Table 3. Factor loadings of the rotated component

Below, a confirmatory factor analysis (CFA) was performed. Table 4 displays two often utilized fit indices in covariance structure analysis. These indexes offer insights into the level of agreement between the theoretical model and the observed data. The obtained Comparative Fit Index (CFI) value of 0.901 suggests that the model adequately matches the data, albeit with potential room for enhancement. In contrast, the

Tucker-Lewis Index (TLI) demonstrates a value of 0.876, indicating an acceptable level of adequacy for the model. Nevertheless, it is advisable to consider implementing certain enhancements to the proposed model, as Keith (2019) suggests that the desired benchmark to aim for is a value of 0.900 or above.

Index	Value
Comparative Fit Index (CFI)	0.901
Tucker-Lewis Index (TLI)	0.876

Note. Reported $\chi 2$ and p-values reflect the fit of the models. For the factorial model, $\chi 2(137) = 1,143,081$; $p < .001$, indicating a statistically significant fit.

Table 4. Fit indices

The data pertaining to the Root Mean Square Error of Approximation (RMSEA), a metric that quantifies the error in approximation relative to the degrees of freedom, is displayed in Table 5. The RMSEA is often regarded as a measure of absolute fit. Smaller values are indicative of a more optimal alignment between the model and the dataset. Regarding this matter, a RMSEA value of 0.080 is considered to indicate a satisfactory level of fit. More precisely, when the number is below 0.05, it indicates a high level of fit, whilst values around 0.08 reflect a moderate level of fit that can be considered adequate or acceptable. Conversely, numbers beyond 0.10 indicate a suboptimal level of fit. Furthermore, it is crucial to note that the 90% confidence interval for RMSEA ranges from 0.085 to 0.095. The entire interval is found to be more than 0.05 and tends to reach or surpass 0.08, so providing evidence that the model's fit is inside the acceptable range.

The Goodness of Fit Index (GFI) is a statistical measure that quantifies the extent to which a model explains the variance in the data. The GFI value of 0.969 indicates a high level of fit between the model and the data, suggesting a good fit. Typically, GFI values exceeding 0.95 are suggestive of a favorable match.

Metric	Value
Root Mean Square Error of Approximation	0.090
RMSEA 90% CI Lower Bound	0.085
RMSEA 90% CI Upper Bound	0.095
Goodness of Fit Index (GFI)	0.969

Table 5. Other Fit Measures

Figure 1 displays route coefficients that illustrate the associations between Digital Skills (DS) and Digital Citizenship (DC) across varying degrees of intensity. The association between Efficient and Effective Information Access (AIMEE) and DC can be described by a coefficient of 0.028, indicating a modest strength despite implying a direct relationship. This suggests that the ability to acquire information efficiently has a limited impact on the development of Digital Citizenship (DC).

In contrast, with regards to the application of new and traditional media formats (AFNTM) in relation to DC, the coefficient of 0.095 suggests a direct influence, albeit with a modest level of intensity on DC. Put differently, the capacity to utilize various media formats has a minimal influence on the development of Digital Citizenship (DC).

On the other hand, the association between the Development of skills for inquiry in networks (DHIR) and DC, as indicated by a coefficient of 0.291, demonstrates a moderate yet significantly stronger effect in comparison to AIMEE and ANTMF.

Moreover, there exists a substantial correlation coefficient of 0.431 between the acquisition of skills for engagement in both offline (face-to-face) and online (virtual) contexts (DPOVO) and the Formation of

Digital Citizenship (FDC). This finding highlights the robust association between the aforementioned abilities and the concept of DC. This finding indicates that the development of Digital Citizenship is most significantly influenced by the acquisition of participation skills, both in offline and online contexts.

In conclusion, when considering the promotion of media and informational literacy (MIL) among students and the management of required changes (MRC) in relation to FDC, it is observed that there exists a direct association with a coefficient of 0.038. However, it is important to note that this influence is quite modest.

The findings of the R-squared (Coefficient of Determination) and Adjusted R-squared, as depicted in Figure 1, indicate a significant level of predictive capability. The R-squared value of 0.525 indicates that over 50% of the variance in FCD can be accounted for by the independent variables under investigation. The model's accuracy and relevance are further supported by the adjusted R-squared value of 0.523, which considers the number of predictors.
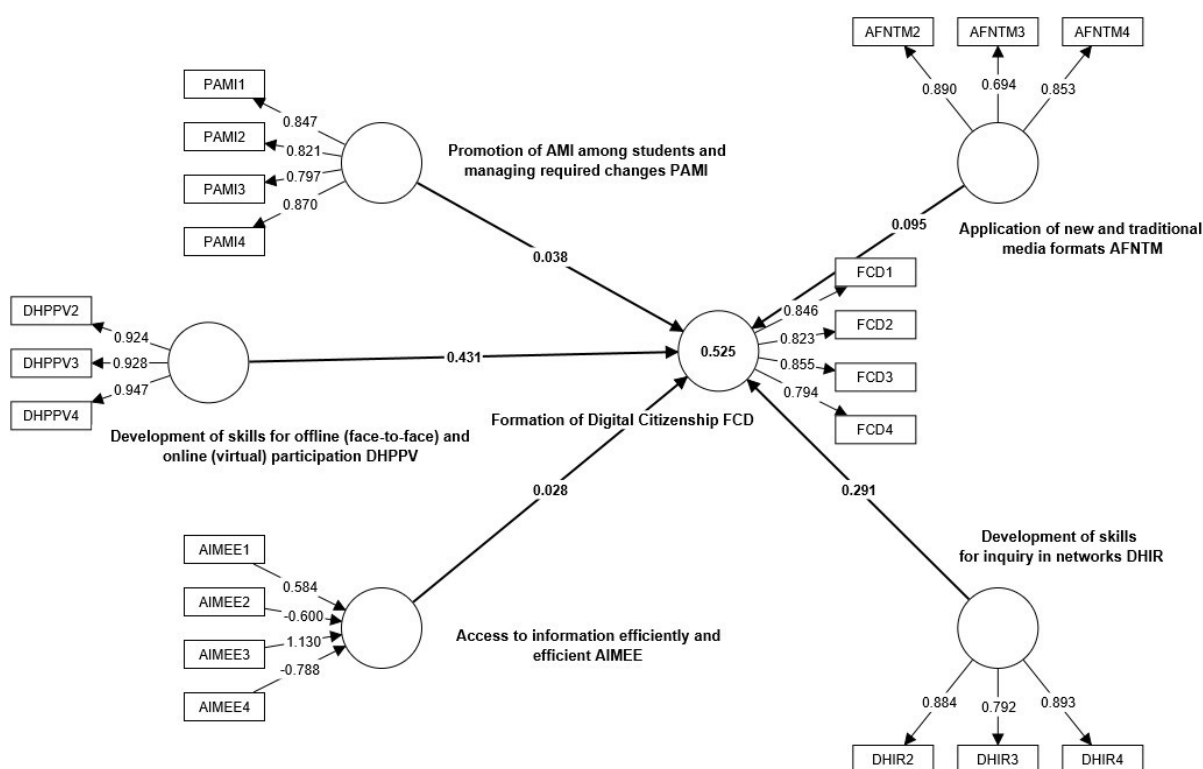

Figure 1. R^2 according to PLS SEM

The examination of multicollinearity in formative models, such as the one utilized for the variable Access to Information efficiently and efficient (AIMEE), is facilitated by the analysis of collinearity using the Variance Inflation Factor (VIF). This tool assumes significance in assessing the presence of collinearity. The Variance Inflation Factor (VIF) is utilized to quantify the extent to which the variance of a coefficient is inflated as a result of the existence of collinearity. In broad terms, VIF values that surpass 5 (although other scholars propose a more cautious threshold of 10) are seen as symptomatic of problematic multicollinearity. Based on the obtained results for AIMEE1 (Variance Inflation Factor [VIF] = 2.580), AIMEE2 (VIF = 1.880), AIMEE3 (VIF = 1.835), and AIMEE4 (VIF = 3.230), it can be inferred that the VIF values for the AIMEE indicators are below the widely acknowledged threshold of 5. This indicates the absence of substantial multicollinearity concerns among the indicators of this formative variable. Despite having the highest value of the variance inflation factor (VIF) among the indicators, indicator AIMEE4 stays far below the threshold, indicating that it does not pose a substantial issue in terms of collinearity (Hair Jr, Sarstedt, Hopkins & Kuppelwieser, 2014).

Table 6 displays the outcomes of assessments conducted to evaluate the reliability and validity of the constructs. In order to accurately comprehend and analyze these findings, it is imperative to establish clear definitions for each statistic. The Cronbach's alpha coefficient is employed to assess the internal consistency of items within a construct. Acceptable values for this coefficient are often above 0.7. Rho A is an alternative measure of reliability that bears similarities to Cronbach's alpha, although is frequently seen as possessing greater robustness. In this particular scenario, a number exceeding 0.7 is seen as favorable. Regarding Composite dependability (CR), it assesses the factor loadings of the items, with values exceeding 0.7 indicating favorable dependability. Lastly, the Average variation Extracted (AVE) quantifies the extent to which the construct captures the overall variation, taking into account the volatility attributed to measurement error. Within this particular context, values that exceed 0.5 are deemed to be acceptable, and values over 0.7 are classified as good.

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Application of new and traditional media formats.	0.766	0.875	0.856	0.667
Development of skills for inquiry in networks.	0.821	0.847	0.892	0.735
Development of skills for offline (face-to-face) and online (virtual) participation.	0.926	0.928	0.953	0.871
Formation of Digital Citizenship.	0.849	0.851	0.898	0.688
Promotion of Media and Informational Literacy (AMI) among students and handling required changes.	0.857	0.895	0.901	0.696

Table 6. Construct Reliability and Validity

In order to evaluate the discriminant validity according to the Fornell-Larcker criterion (Fornell & Larcker, 1981), it is necessary to satisfy the following requirement: the square root of the Average Variance Extracted (AVE) for a particular construct (represented by the diagonal values) must exceed the correlations between that construct and the other constructs in the model (represented by the off- diagonal values within the same row/column). In the present context, let us examine the construct denoted as AFNTM. The square root of the average value of the absolute error for the algorithm AFNTM is 0.817. The correlation coefficients between AFNTM and other constructs, such as DHIR (0.507) and DHPPV (0.344), are all exceeded by this figure. This finding suggests that there is robust evidence of discriminant validity for the AFNTM construct, as shown in Table 7.

	AFNTM	DHIR	DHPPV	FCD	PAMI
Application of new and traditional media formats AFNTM	0.817				
Development of skills for inquiry in networks DHIR	0.507	0.857			
Development of skills for offline (face-to-face) and online (virtual) participation DHPPV	0.344	0.655	0.933		
Formation of Digital Citizenship FCD	0.419	0.637	0.664	0.830	
Promotion of AMI among students and managing required changes PAMI	0.661	0.449	0.262	0.346	0.834

Table 7. Analysis of the Fornell-Larcker criterion for verification and discriminant validity

The Heterotrait-Monotrait (HTMT) criterion is an additional method for evaluating discriminant validity (Henseler, Ringle & Sarstedt, 2015). This approach involves the calculation of the link between correlations of indicators from multiple constructs (heterotrait) and correlations of indicators from the same construct (monotrait). Based on the data presented in the table, it can be observed that the HTMT value between DHIR and AFNTM (0.611) falls below the threshold of 1. This finding serves as a favorable indication of discriminant validity. This phenomenon is similarly observed in the remaining pairs of constructions listed in the table. It is important to acknowledge that HTMT values that are considered

acceptable are typically expected to be below 0.85 or 0.90. However, it is worth noting that these specific criteria may differ based on the authors and the specific field of study, as indicated in Table 8.

	AFNTM	DHIR	DHPPV	FCD	PAMI
Application of new and traditional media formats AFNTM					
Development of skills for inquiry in networks DHIR	0.611				
Development of skills for offline (face-to-face) and online (virtual) participation DHPPV	0.356	0.740			
Formation of Digital Citizenship FCD	0.477	0.750	0.743		
Promotion of AMI among students and managing required changes PAMI	0.849	0.519	0.279	0.390	

Table 8. Heterotrait-Monotrait Ratio – HTMT criterion for discriminant validity verification

Based on the findings shown in Table 9 and according to the usual criterion of a p-value below 0.05 to determine statistical significance, we can derive the following interpretations regarding the hypotheses. The hypothesis test H1 conducted between variables AIMEE and FCD yielded a p-value of 0.307. Put simply, the significance level exceeds the threshold of 0.05, suggesting that the statistical model does not provide sufficient evidence to establish a meaningful association between accessibility to effective and efficient information and the formation of digital citizenship. The statistical analysis of H2 (AFNTM => FCD) reveals a p-value of 0.003, which falls below the conventional significance threshold of 0.05. This finding suggests a noteworthy association between the utilization of both contemporary and conventional media forms and the development of digital citizenship. In relation to H3 (DHIR => FCD), the obtained p-value of 0.000 indicates a strong and statistically significant association between the acquisition of inquiry skills in networks and the establishment of digital citizenship. In the case of H4 (DHPPV => FCD), a p-value of 0.000 is seen, suggesting a statistically significant association. This implies that the acquisition of participation skills, in both offline and online contexts, significantly influences the establishment of digital citizenship. In the present study, the statistical analysis reveals that the association between the promotion of media and informational literacy among students and the creation of digital citizenship is not considered statistically significant in this particular model, as evidenced by the derived p-value of 0.108.

Consequently, among the five hypotheses examined, hypotheses H2, H3, and H4 have been deemed acceptable, however H1 and H5 have been deemed unacceptable, as determined by the outcomes of the bootstrapping analysis and the level of statistical significance (refer to Table 9).

Hypothesis	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
H1: Effective and Efficient Access to Information AIMEE => Digital Citizenship Formation FCD	0.028	0.003	0.056	0.504	0.307
H2: Application of New and Traditional Media Formats AFNTM => Digital Citizenship Formation FCD	0.095	0.094	0.034	2.750	0.003
H3: Development of Inquiry Skills in Networks DHIR => Digital Citizenship Formation FCD	0.291	0.292	0.042	7.001	0.000
H4: Development of Offline (Face-to-Face) and Online (Virtual) Participation Skills DHPPV => Digital Citizenship Formation FCD	0.431	0.431	0.044	9.817	0.000
H5: Promotion of Media Literacy among Students and Management of Required Changes PAMI => Digital Citizenship Formation FCD	0.038	0.038	0.031	1.238	0.108

Table 9. Hypothesis Testing - Bootstrapping

4. Discussion

The current research challenges the traditional perspective on the importance of access to information for digital citizenship. Although this access is still relevant, our findings suggest that skills such as insight and information filtering are more crucial in the age of information overload. This reflects an evolution in the understanding of digital citizenship, where the ability to manage and critically evaluate information becomes as important as access. It was observed that interaction and active engagement in the digital sphere are fundamental for digital citizenship. This underscores the need to go beyond passive information consumption and actively create and participate in digital environments.

The research by Cho et al. (2022) on media literacy in social media finds echo in our findings. The importance of skills such as navigation, curation, evaluation, and digital creation is increasingly evident in the current digital ecosystem. These skills are essential to effectively navigating a world where information is abundant and often overwhelming.

Kim and Choi (2018) highlighted the importance of digital information's ethical and social aspects, which is also reflected in our results. Forming responsible digital citizenship involves not only the management of information but also understanding its ethical and social impact.

Gómez-Ponce & Pardo (2007) and Fajardo-Pascagaza and Serrano-Carrascal (2022) discussed how digital media and social networks reform identity and citizen participation. Our findings support this idea, showing how interaction with these media is crucial for digital citizenship in the 21st century.

Hobbs (2010) and Schreurs and Vandenbosch (2021) focused on the essential components of digital literacy, from accessing and evaluating information to safe and responsible interaction in digital environments. These components have proven fundamental in our research, highlighting the need for a holistic and multifaceted understanding of digital literacy.

DeLuca et al. (2015) and Pino, González and Ahumada (2018) highlighted the importance of collaborative inquiry in forming digital citizenship. Our findings support this view, indicating that the ability to collaborate and communicate effectively on digital platforms is increasingly valued.

Finally, Carrillo and Aguirre (2021) and Wilson et al. (2011) discussed the importance of information media literacy (IMA) in education. Although our results suggest that MIL is necessary, they also indicate that it must be complemented with other digital skills to effectively train digital citizens. This research

highlights the evolution and complexity of the concept of digital citizenship. Digital skills are essential, but their relationship to digital citizenship is nuanced and multifaceted. These findings offer valuable insight for future educational and training efforts in the digital age, underscoring the importance of adapting and evolving educational approaches to meet the demands of an ever-changing digital world.

5. Conclusions

This study unequivocally affirms that interaction and active participation are indispensable to the fabric of the digital world. The profound influence of participatory skills on the development of Digital Citizenship, relevant across both offline and online settings, underscores the critical need for a shift from passive observation to active, critical engagement within digital domains. This paradigm shift is not merely advisable but essential, reflecting the evolving demands of digital fluency in contemporary society.

The research illuminates a significant correlation between the acquisition of inquiry skills within digital networks and the broader construct of Digital Citizenship. In an information-saturated age, the ability to discern the validity and relevance of information transcends basic digital literacy, emerging as a cornerstone of digital competence. This skill becomes increasingly paramount in an era dominated by misinformation and the proliferation of fake news, where the capacity to critically evaluate information sources directly impacts both individual and collective decision-making processes.

Furthermore, the findings reveal that the contribution of various digital skills to the development of Digital Citizenship is not uniform, challenging the notion of a one-size-fits-all approach to digital education. This heterogeneity in impact necessitates a nuanced evaluation of educational frameworks, urging a prioritization of skills that markedly enhance digital proficiency. The predictive model of Digital Citizenship, bolstered by a determination coefficient (R^2) of 0.525, convincingly demonstrates that over half of the variance in Digital Citizenship development can be explained by the variables under study. This not only reaffirms the relevance of the selected digital competencies but also attests to the methodological rigor of our investigation.

These conclusions transcend mere academic discourse, offering actionable insights for the design and implementation of educational initiatives aimed at cultivating digital citizens who are not only technologically proficient but also ethically grounded and critically engaged. As digital landscapes become increasingly integral to all aspects of life, the imperative for education systems to adapt and foster skills that enable meaningful participation and critical engagement in the digital realm has never been more pressing. The development of such competencies is crucial for empowering individuals to navigate, contribute to, and ethically shape the digital world, ensuring a resilient and informed citizenry capable of facing the challenges of the digital age.

Declaration of Conflicting Interests

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