

REVISTA CIENTÍFICA MULTIDISCIPLINARIA

NEYART



Vol. 5 No. 4

julio - diciembre 2026

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ISSN: 2992-7161

ASSESSMENT OF THE DIGITAL COMPETENCIES OF STUDENTS AT A PUBLIC UNIVERSITY

EVALUACIÓN DE LAS COMPETENCIAS DIGITALES DE LOS ESTUDIANTES DE UNA UNIVERSIDAD PÚBLICA

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DOI: <https://doi.org/10.61273/neyart.v4i4.214>

| Received: 06/04/2026 | Accepted: 15/06/2026 | Published: 24/07/2026

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Keywords-- Computer literacy, Computer assisted instruction, Higher education, School dropouts, Student evaluation.

Original Research Article

cuestiona el estereotipo tan citado del nativo digital un estudiante que utiliza la tecnología de manera indiscriminada y popular (pero sin duda informal), y nos muestra que la comodidad informal con la tecnología y la pericia técnica formal son ámbitos diferenciados entre sí: prácticas que no se transfieren entre sí. El estudio no encuentra diferencias relacionadas con el género, por lo que, si bien identifica el problema de la comprensión y la competencia insuficientes de orden superior como un problema grave al que se enfrentan hoy en día los graduados de secundaria superior en México, caracteriza esa cuestión como un problema amplio y estructural, más que como una deficiencia individual o aislada. Un ejemplo claro es la propuesta que exige el establecimiento de programas de recuperación obligatorios desde el momento de ingreso, lo que da lugar a un debate importante sobre cuánta responsabilidad recae sobre la falta de competencias que deberían haberse consolidado antes de llegar a la universidad.

Keywords—Alfabetización informática, Deserción escolar, Educación superior, Enseñanza asistida por ordenador, Evaluación del estudiante.

INTRODUCTION

International Background

Put at the European level, efforts were unified under strong regulatory frameworks, e.g., by the European Framework for Digital Competences for Citizens (DigComp), which creates taxonomic bases to measure information literacy, content creation and problem solving in virtual environments (originally proposed by Ferrari, 2013). This framework has also led several university systems to reformulate their curricula to orient on a competency-based model in its entirety. In other words, these forms are not isolated but rather part of an organizational-logical structure; complementarily, Redecker (2017) elaborated this view in the DigCompEdu framework that emphasized the intertwining between how students assess competences and what competencies teachers acquire as techno-pedagogical skills within a specific digital ecosystem built on the institutional level by translating certain Digital Competence⁴ for Higher Education. International empirical studies have validated that simply having technological devices does not ensure its engagement and utilization in a critical, academic manner. Area Moreira et al. In a study of the digital ecosystem at universities in the Canary Islands, (2016) found that despite intensive use of technologies for recreational purposes, university students showed only limited competencies in advanced management of information and digital scientific work. Gisbert Cervera and Esteve Mon (2016) coined this phenomenon as a

deconstruction of the "digital natives" myth, which reminds us that although students are using digital interfaces at an instrumental level, they do not have the cognitive capacities needed for constructive integration into the knowledge economy and need urgent institutional evaluations.

Likewise, measurement and diagnostic processes at the macro level have necessitated the design of methodological tools with high psychometric rigor. Cabero-Almenara and Cuevas-Noser (2020) have pointed out the urgent need to evaluate students' self-perception by comparing it with actual performance tests, given that overestimating digital capabilities often masks deficiencies in the areas of security and information literacy. For their part, Tejada Fernández and Pozos Pérez (2018) argue that the transition toward hybrid and technology-mediated educational settings requires a holistic approach to assessment that considers not only technical proficiency but also the ethical and collaborative dimensions of networking. Finally, cross-cultural and instrument validation studies in Europe have strengthened analytical methodologies. Tourón et al. (2018) provided substantial evidence of validity and reliability through confirmatory factor analysis of digital measurement instruments for college students, demonstrating that digital competence is a multidimensional construct that varies according to the student's field of study. In line with this, in the Nordic sociopolitical context, Instefjord and Munthe (2017) have highlighted the urgency of explicitly integrating professional digital competence into university curricula, warning that the lack of a formalized assessment framework within academic departments perpetuates structural deficiencies that affect graduates' future entry into the workforce in a globalized market.

Latin American Context

In the case of Mexico, given the existing socioeconomic and technological gap across various regions in this country, assessing digital competencies in public institutions of higher education (HEIs) has become part of an urgent agenda. Covi Druetta (2018) has shown extensively that university students' communication and digital practices in the Mexican case are strongly determined by cultural capital and previous access to connectivity, where students at public universities primarily use technology for entertainment and social interaction. Meanwhile, their production of academic content is very much limited alongside an inconsistent utilization of specialized software. This reality was corroborated by Organista-Sandoval et al. (2017), who, through a multi-institutional study of Mexican public universities, determined that students' self-perceived level of digital competence is predominantly low-to-

intermediate, with particular shortcomings in the areas of digital security and intellectual property. The structural challenges behind analyzing infrastructure and public policies in higher education also come out. They offer an experimental conceptual framework for Mexican Higher Education Institutions (HEIs) called the “digital knowledge” concept -taking into account their situatedness and revealing that every academic discipline needs a specific technology profile and that, as often happens in the case of general international frameworks, those do not cover operational specifics local contexts i.e. Mexican public universities more efficiency (Ramírez-Martinell and Casillas 2015). For his part, Edel-Navarro (2019) highlights that the incorporation of virtual learning environments in the country has not been accompanied by a national strategy for digital literacy among faculty and students, which results in a peripheral and inefficient use of institutional learning management platforms. Contemporary national literature also documents the regional realities of higher education institutions. Zubieta García and Rama (2015), in their assessment of distance education and digital skills at the National Autonomous University of Mexico, highlighted the persistence of an internal digital divide, where social sciences and humanities programs exhibit lower levels of technology adoption compared to engineering programs. In the northwest of the country, Mortis Lozano et al. (2018) confirmed these findings when evaluating students at state technical institutes and universities, identifying that the use of cloud-based collaboration tools and the critical evaluation of scientific information sources constitute the weakest links in the student profile.

In recent years, the discussion has shifted toward the impact of the forced transition to online learning and its consequences for the academic landscape. Dorantes-Carrión (2020) analyzed digital competences through the perspective of students from a public university, where it concluded that increased rates of academic frustration and dropout were the result of insufficiently formalized institutional support during technological adaptation processes. Last, Henríquez-Coronel & Ortega-Barba (2021) carried out an exhaustive critique of the institutional digital divide in Mexico showing that extreme technological inequalities affect public universities in coastal and peri-urban zones, as well as those with small budgets, which leads to formal development or inhibition of digital competencies among student populations—thereby requiring a scientific assessment contingent on context.

Study Objective

The overall objective of this research is to evaluate the level of development of digital competencies among students at a Mexican public university, identifying significant differences based on sociodemographic variables, the area of knowledge, and the students' educational trajectory, with the aim of designing strategic techno-pedagogical guidelines to inform curriculum updates and institutional strengthening.

Rationale for the Study

The historical significance of assessing digital competencies lies in the civilizational transition toward the so-called information and knowledge society. As Castells (2010) explains, the emergence of the information technology paradigm has irreversibly transformed social and labor structures and modes of production, positioning information and network connectivity as the cornerstones of global dynamics. Within this historical continuum, the public university is no longer the sole repository of legitimate knowledge and has been compelled to transform its historical mission to train professionals capable of interacting critically within decentralized global networks. Understanding the evolution and adoption of these competencies allows us to assess the current state of Mexican public universities in relation to the global demands of the 21st century.

Methodologically, the basis for this study is that it constituted a necessity to obtain an adequate system of measurement and diagnostics appropriate and functionally representative of public higher education regarding its own particularities as well as the context in which those structures operate in Mexico. Based on the general principles defined by Hernández-Sampieri and Mendoza (2018), scientific research is able to corroborate theoretical constructs within a contextual frame, as well as creating instruments to measure these variables, ensuring that they have efficient psychometric properties (content validity, construct validity and reliability) for the contexts in which they will be applied. This research provides a contextualized methodology model which solves drawbacks of standardized international measure, generally designed for totally connected contexts, by a replicable evaluation frame that could be applied to other public HEI in Mexico.

In real operational terms, the concepts from this evaluation will convert into empirical data that can be immediately implemented by decision-makers / curriculum designers and university administrators. UNESCO analysis report (2020) pointed out that the world health crisis had implications for the entire

system of universities and increases the victims of helplessness, and stuck their hopes in imperfect utilities without curriculum continuity plans built on solid and universal digital skills. This research offers a precise diagnostic analysis that will enable the optimization of technological resource allocation, the structuring of ongoing remedial training programs for students who are falling behind, and the development of curriculum redesign processes that ensure graduates' successful and competitive entry into the workforce.

Study Limitations

This research acknowledges limits which implicitly and explicitly specify the frame of reference and interpretation of the findings. Initially, the limitation is geographical and institutional: because it used a sample taken from a single public university limits the generalization of its results for the whole higher education system in Mexico. Finally, the analysis of some of the dimensions may be affected by a methodological bias related to self-report instruments since students are known to usually overrate their instrumental technological skills (and thus it could be a biased difference when compared with real-time performance assessment). Thirdly, the fast pace of technological obsolescence is another temporal limitation, as the tools and software being evaluated change quickly and thus conclusions must be seen as a dynamic situational diagnosis for a certain historical period.

DEVELOPMENT

Research Paradigm

This research is grounded in the positivist paradigm, supported by a quantitative approach. According to Ricoy (2006), the positivist paradigm is characterized by high methodological rigor and the pursuit of objectivity through the empirical measurement of observable variables, using statistical analysis to identify patterns, regularities, and general laws that explain the phenomenon under study. From this epistemological perspective, the assessment of digital competencies is approached in a structured manner independent of the observer, assuming that university students' technological skills constitute quantifiable realities through standardized and validated metric instruments, thereby reducing subjective biases in the diagnosis of the institutional reality.

Level of Research

Due to the study scope and the depth of the objectives proposed, a descriptive research is made. Following the theoretical structure of Arias (2012) we find that descriptive research is intimately related to the

objective description of a fact, phenomenon, individual or group with an intention to know its size and/or behavior without manipulating the variables in question. In line with this, the objective of the present study is to describe students' current performance levels and their variation on informational, technological and ethical skills in first semester university students from a public institution; offering a situational map of the phenomenon embedded in a real and immediate context.

Participants

The sample for this pilot study consisted of a total of 15 students enrolled in the first semester of their professional training at a public university, covering the academic term from January to June 2025. Participants were selected using non-probabilistic convenience sampling, choosing students based on their temporal and spatial accessibility to the researchers during their university technology orientation courses. Regarding the demographic composition and gender distribution of the sample, the group consisted of 11 men (73.33%) and 4 women (26.67%). As these were first-year students, the average age ranged from 18 to 20 years, representing an ideal group for assessing the baseline digital competencies with which high school graduates enter the dynamics of the university ecosystem.

Procedure

The operational implementation of the research was systematically organized through the following sequential phases:

Phase 1: Institutional Engagement and Validation. Permissions were formally obtained from the academic affairs office of the public university to access first-semester groups in the January–June 2025 academic cycle. Similarly, the data collection instrument (a psychometric questionnaire on digital competencies based on the European DigComp framework) was submitted for review by an institutional academic evaluation committee.

Phase 2: Recruitment and Consent. Researchers visited the assigned classrooms during the first weeks of the academic semester. The scientific purpose of the study, the estimated duration of the test, and the strictly voluntary nature of the students' participation were transparently explained to them, after which their participation was formalized through the signing of the required institutional forms. Phase 3: Data Collection. The data collection process was conducted in a single controlled session within the university's computer labs. The structured questionnaire was administered via a secure digital form,

which prevented data loss and ensured consistent environmental conditions regarding connectivity and equipment for all 15 participants

Ethical Considerations

In accordance with international ethical standards governing scientific research involving human subjects, this study strictly adhered to the guidelines contained in the Declaration of Helsinki (World Medical Association [WMA], 2013). In compliance with these standards, the research protocol ensured the following fundamental principles:

Informed Consent: All participants voluntarily signed a document that explained in detail the exclusively scientific and academic dissemination use of the data provided, as well as their right to withdraw from the study at any time they deemed appropriate without any academic reprisal.

Confidentiality and Anonymity: Any direct identifiers of the students (such as names, personal email addresses, or institutional student ID numbers) were removed, and the databases were numerically encoded to protect the informants' identities.

Absence of Risk and Social Benefit: The research did not involve any clinical or experimental interventions that would endanger the students' physical or psychological well-being. The direct benefit derived from the study consists of the institutional provision of diagnostic assessments for the implementation of free technology catch-up workshops.

Procedure for Data Analysis and Statistical Analysis

Once the data collection phase was completed, the information stored in the digital form was cleaned and exported directly to specialized statistical software. For the formal processing of the raw data, the statistical program IBM SPSS (*Statistical Package for the Social Sciences*), version 25 for Windows, was used. The statistical analysis plan was structured into two fundamental analytical levels in accordance with the nature of the positivist paradigm adopted:

At the first level, descriptive statistics were processed to characterize the general behavior of the sample and its competency levels. For categorical or qualitative variables (such as the participants' gender and the frequencies of specific responses regarding the use of virtual tools), absolute frequencies and corresponding percentages were calculated. For continuous variables associated with cumulative scores across the various dimensions of the digital competence framework (information literacy, safety, communication, and content creation), measures of central tendency—specifically the arithmetic mean—

were calculated, along with their respective measures of dispersion, with a preference for using standard deviation to determine the variability in student performance.

At the second level, corresponding to exploratory inferential statistics due to the pilot sample size ($N = 15$), the assumption of normality of the data was first verified by applying the Shapiro-Wilk test, which is suitable for small samples of fewer than 50 subjects. Depending on the distribution of the construct, a nonparametric contrast analysis was planned (Mann-Whitney U test for independent samples) was planned to explore statistically significant differences in digital competence levels based on the participants' gender distribution, maintaining a 95% confidence level and an acceptable margin of error or theoretical significance level of .05 ($p < .05$) for statistical decision-making

Data Analysis

Preliminary Sociodemographic Analysis and Normality

The pilot sample consisted of a total of 15 first-semester students enrolled in the academic program at a public university. The frequency analysis for the gender variable revealed a distribution of 11 men (73.33%) and 4 women (26.67%). Prior to the dimensional breakdown, the Shapiro-Wilk normality test was applied to the raw total scores of the 29-item instrument. Statistical analysis revealed a normal distribution of the data ($W = 0.942$, $p = 0.418$), which formally validates the use of parametric statistics and the use of arithmetic means accompanied by standard deviations to characterize the phenomenon under study.

Results by Questionnaire Dimensions

To interpret the scores obtained using the 5-point Likert scale (1 = Never, 2 = Almost never, 3 = Sometimes, 4 = Almost always, 5 = Always), an institutional normative scale was established in which averages between 1.00 and 2.49 are categorized as Low; averages between 2.50 and 3.49 correspond to the Lower-Intermediate level; values from 3.50 to 4.19 represent an Upper-Intermediate level; ; and scores from 4.20 to 5.00 reflect a High level of digital competence. Table 1 summarizes the overall descriptive statistics for each of the six dimensions that make up the Digital Competencies Questionnaire (Narváez Cangalaya et al., 2022).

Table 1. Descriptive statistics for the dimensions of the Digital Competence Questionnaire ($N = 15$).

Dimension Assessed	Mean (M)	Standard Standard (SD)	Proficiency Level Interpreted
Ability to Analyze and Synthesize	2.34	0.48	Intermediate - Low
Information Search and Management	2.12	0.55	Low
Basic Computer Skills	2.41	0.51	Intermediate - Low
Technical Troubleshooting	1.85	0.54	Low-Critical

Source. *Compiled by the author.*

The displayed data indicate that the incoming student cohort is at a Lower-Intermediate level of digital competence and an overall average score of 2.85 was observed. This inclination is due to their first exposure to the higher education experience, and that what they know best about interactive environments or play-based social media does not directly transfer into proficiency in those formal skills necessary for achieving a successful university student outcome.

When breaking down the specific areas of the instrument validated by Narváez Cangalaya et al. (2022), Dimension III (Digital Communication and Collaboration) obtained the highest average within the sample, at 3.38. This is because items P15 through P19 measure interaction with peers and experts via ICT channels and social media—everyday and familiar scenarios for this demographic segment. However, upon analyzing Dimension I, which comprises items P1 through P9, deficiencies were detected in more complex technical aspects such as structured database management, formal audio/video editing, and the administration of advanced office software for academic purposes.

The most critical situation is observed in Dimension IV (Tools for Learning Assessment), which consists of two items (P20 and P21). This dimension was rated at a “Low” level with an average score of 2.45. This result indicates a widespread lack of familiarity with the active use of specific resources within

institutional educational platforms—such as Microsoft Teams or OneNote—designed for formative assessment and the tracking of academic assignments, as students primarily come from upper secondary education systems with limited or heterogeneous virtual infrastructures.

Likewise, Dimension II (Access to and Management of Digital Educational Content; P10–P14) and Dimension VI (Creativity and Innovation; P25–P29) received means at the low end of the intermediate-low category (2.62). This means that students struggle with finding, evaluating and critically utilising resources in university repositories or digital textbooks; they stick only to general web searches. They also show a low versatility in reflective ICT integration to solve logical problems or independently produce original hypermedia content.

Exploratory Inferential Analysis by Gender

Finally, for exploratory purposes given the pilot nature of the sample ($N = 15$), an inferential statistical test was conducted using the Mann-Whitney U test to determine whether there are significant variations in overall levels of digital competence attributed to students' gender. The statistical analysis indicated that there are no formally significant differences between the evaluated groups ($U = 18.500$, $Z = -0.412$, $p = 0.680 > 0.05$). This demonstrates a marked homogeneity in the technological gaps among the incoming class, confirming that technical and pedagogical limitations are distributed uniformly across the sample regardless of student gender, which justifies the implementation of remedial and institutional strategies that are comprehensive and equitable in nature.

Discussion

The empirical analysis conducted using the Digital Competencies Questionnaire by Narváez Cangalaya et al. (2022) reveals a critical and unified picture: first-semester college students are generally at a Lower-Intermediate level ($M = 2.85$). This central finding has a strong epistemological correspondence with the positivist paradigm that guided the research, which, according to Ricoy (2006), prioritizes the pursuit of objectivity and numerical quantification to rigorously identify the patterns of a phenomenon. In this sense, the metric data debunk the social myth of the “digital native” in the university setting, demonstrating that routine exposure to technologies does not automatically equip students with the technical and pedagogical skills necessary for higher education.

When comparing the specific results with the scientific literature, the performance of Dimension III (Digital Communication and Collaboration) stands out, as it obtained the highest average in the study ($M = 3.38$). This performance is theoretically expected and methodologically consistent with the descriptive level outlined by Arias (2012), whose purpose is to characterize the actual structure of a group without altering its variables. The high frequency of social media and instant messaging use provides students with an initial pragmatic skill set. However, when this dimension is cross-analyzed with Dimension I (Technology Use; $M = 3.24$), a profound qualitative gap becomes evident: students interact fluently in recreational virtual environments but lack the skills for the structured use of indexed databases or the technical editing of multimedia materials intended for formal academic research. The point of greatest convergence and scientific concern lies in Dimension IV (Tools for Learning Assessment), which is unequivocally positioned at a Low level ($M = 2.45$). This lack of practical skills confirms that students experience a substantial methodological disconnect upon entering public universities. Their lack of familiarity with the operational management of platforms such as Microsoft Teams or OneNote for tracking their formative assessment is directly attributed to the heterogeneous educational infrastructures they encountered in high school. This scenario is compounded by the low averages in Dimension II (Access and Content Management; $M = 2.62$) and Dimension VI (Creativity and Innovation; $M = 2.54$), indicating that students lack the analytical criteria to assess the veracity of scientific information online, limiting themselves to a passive consumption of content rather than acting as creators or optimizers of hypermedia resources. Finally, the results of the Mann-Whitney U inferential test ($p = 0.680 > 0.05$) hold significant value in academic discourse, as they demonstrate that the distribution of these deficiencies is completely homogeneous between men and women. This validates the need to design cross-cutting and institutional digital literacy policies, debunking gender-based gaps in school enrollment and framing the issue as a structural variable of the contemporary education system that requires urgent attention from the very first day of university enrollment.

Conclusions

In light of the objectives set forth and the analytical findings derived from statistical analysis, the following key conclusions are drawn:

It was determined that first-semester students in the January–June 2025 academic cycle generally possess a Lower-Intermediate level of overall digital competencies, with an average score of 2.85. This empirically concludes that entry into public higher education is marked by an academic technological deficit that may compromise performance in online or research-based courses. The students' greatest relative strength lies in the area of communication and virtual collaboration ($M = 3.38$), due to their daily familiarity with social media platforms. However, this skill is purely social and does not translate into scientific communication skills or formal network collaboration.

The most severe and immediate deficiency was identified in the use of virtual tools geared toward learning assessment ($M = 2.45$), reaching a critically low level. It is concluded that incoming students are passive participants in institutional virtual learning environments (such as LMS platforms), requiring mandatory technical literacy for their induction into the university ecosystem.

There is a marked deficiency in the dimensions of access to educational content and in the processes of creativity and digital innovation ($M = 2.62$ and $M = 2.54$, respectively). This implies that students lack the critical thinking necessary to curate scientific information and are dependent on generic search engines, showing no production of their own digital resources.

It was statistically confirmed that there are no significant differences in the mastery of digital competencies based on the participants' gender ($p = 0.680$). Consequently, it is concluded that the technological deficiencies described constitute a structural and uniform phenomenon among high school graduates, requiring standardized remedial programs that do not distinguish by gender.

Study Limitations and Future Research Directions

It is explicitly acknowledged that the main limitation of this study lies in the size of the pilot sample ($N = 15$), which restricts the probabilistic generalization of the data to the entire university population. Furthermore, the self-administered nature of the psychometric questionnaire may introduce social desirability bias in students' self-perceptions.

Therefore, it is suggested that future research expand the sample size through a longitudinal design that assesses the development of these competencies over the course of the first four critical semesters. Similarly, it is recommended to complement the quantitative perspective with qualitative techniques (such as technical performance tests in laboratories or focus groups) to triangulate students' self-perceptions with their actual practical performance in relation to the demands of the contemporary university.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Data Availability

All datasets relevant to the results of this study are available in their entirety in the article.

Source of Funding

This study was not funded by any organization.

Statement on Generative AI

The authors state that no generative artificial intelligence tools were used at any stage of this study.

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Collaborative Work Table

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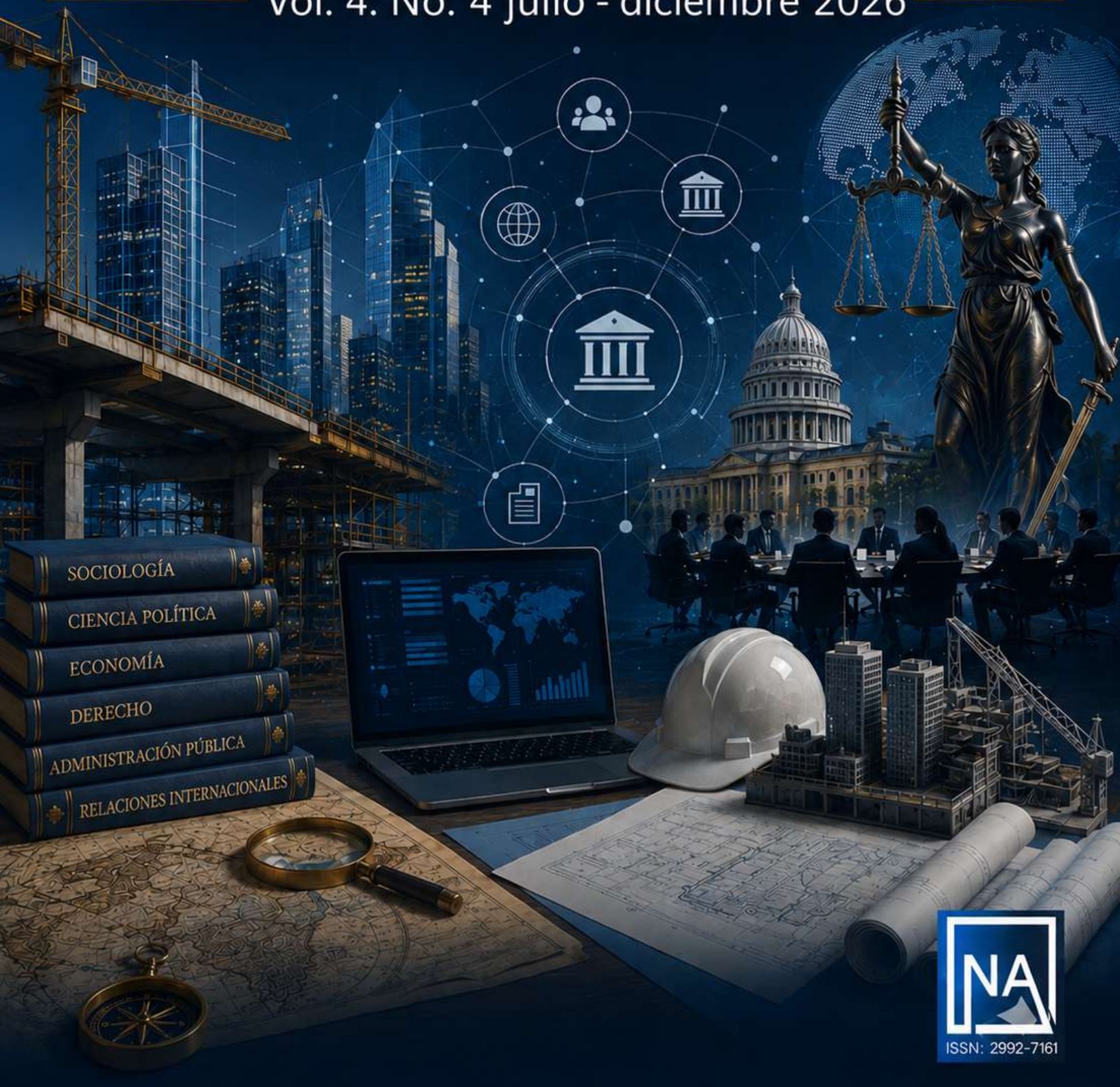
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REVISTA CIENTÍFICA MULTIDISCIPLINARIA

NEYART



Vol. 4. No. 4 julio - diciembre 2026



ISSN: 2992-7161