Research skills mediated by technologies: An analysis of university professors at the University of Granma

Competencias investigativas mediadas por tecnologías: Un análisis del profesorado universitario en la Universidad de Granma

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ABSTRACT

Technology-mediated research competencies enhance the generation of innovative knowledge among teachers, which favors their adaptation to current educational challenges. This research aims to characterize the current state of technology-mediated research competencies among university professors at the University of Granma. A quantitative, exploratory-descriptive approach was used, with a non-experimental design. The sample consisted of 54 professors. The results highlight that 70.4% of the professors show Good and High levels of research competence development, and 29.6% show average or low ratings. The study concludes that 70.4% of the professors possess solid research skills, but 57.4% lack digital research competencies, with only 16.7% at an optimal level. The distribution (48.1% average, 24.1% low) reflects institutional policy demands for training in technological tools for research.

Keywords:

Research skills; Technologies; University professor; Higher education; Teacher training

RESUMEN

Las competencias investigativas mediadas por tecnologías potencian la generación de conocimiento innovador en los docentes, lo que favorece su adaptación a los desafíos educativos actuales. La presente investigación tiene como objetivo caracterizar el estado actual de las competencias investigativas mediadas por las tecnologías en el profesorado universitario de la Universidad de Granma. Se trabajó un enfoque cuantitativo, una investigación exploratorio-descriptivo, con un diseño no experimental. La muestra estuvo conformada por 54 profesores. Los resultados destacan que el 70.4% del profesorado muestra niveles Bueno y Alto en cuanto al desarrollo de competencias investigativas, y el 29.6% con valoraciones medias o bajas. Se concluye que el estudio revela que el 70,4% del profesorado posee habilidades investigativas sólidas, pero el 57,4% carece de competencias digitales para investigación, con solo el 16,7% en nivel óptimo. La distribución (48,1% medio, 24,1% bajo) demandas políticas institucionales de capacitación en herramientas tecnológicas para la investigación.

Palabras clave:

Competencias investigativas; Tecnologías; Profesor universitario; Educación superior; Formación docente

INTRODUCTION

Research, as an essential function for knowledge generation in the university setting, has established itself as a fundamental strategic priority for teaching within Higher Education Institutions (HEIs). In this contemporary context, faculty need to develop research competencies mediated by emerging technologies, encompassing critical inquiry, advanced scientific information management, academic communication in virtual environments, and the innovative use of specialized digital tools for effective and transformative teaching (Buendía et al., 2018).

These competencies, according to Leal and Rodríguez (2024), are fundamental in higher education, since they foster critical and creative thinking, professional autonomy and the application of emerging technologies, in addition to facilitating interdisciplinary collaborations and addressing social problems from a scientific perspective. However, as Muñoz et al., (2011) point out, the current challenge lies in the fact that the management of scientific information increasingly depends on the mastery of digital tools, which requires teachers trained to integrate them into their teaching practices.

In this regard, Fedemar et al. (2011) emphasize that these competencies include the ability to observe, interpret, and systematize educational problems, as well as to design research projects applied to the classroom through the use of technological tools. They also highlight the need for interdisciplinary collaborative work and skills to communicate scientific results in various digital formats, adapting to the demands of a knowledge-based society. According to these authors, teacher training should prioritize mastery of hybrid methodologies that combine traditional educational research with ICT strategies, ensuring a reflective and transformative pedagogical practice.

According to Espinoza et al. (2016), research competencies, defined as an integrated set of knowledge, procedures, and attitudes, are essential for leveraging ICTs in processes such as searching, selecting, and critically evaluating information, especially in educational contexts where digital literacy is a priority. Along these lines, Tuesta

(2021) highlights the importance of providing teacher support in the use of digital tools to foster strategies that strengthen these competencies through ongoing training and pedagogical resources adapted to current needs.

For their part, Antúnez and Veytia (2020) emphasize the importance of developing research competencies with the support of ICTs, as this generates a significant impact on research processes within university settings. This requires teachers to acquire skills to use technological tools, strengthen interdisciplinary collaboration, disseminate scientific results, apply innovative pedagogical practices, and foster the development of comprehensive approaches that integrate critical and reflective skills.

In this regard, the authors of this paper believe that strengthening university professors' research skills through ICT can optimize their research performance, foster pedagogical innovation, generate scientific solutions to social problems, and promote a comprehensive approach that transforms traditional educational practices. This approach seeks to integrate advanced technologies, improve institutional quality, and enhance knowledge construction through the strategic use of digital tools.

The present work aims to characterize the current state of technology-mediated research competencies among university professors at the University of Granma.

METHOD

The study used a descriptive quantitative design, complemented by a quasi-experimental approach. The objective of the research was to determine research competencies through the use of technological tools in the scientific information management process developed by teachers. Furthermore, gaps and inconsistencies between the tools designed, those identified, and those used by teachers were analyzed.

The study population consisted of 125 teachers from the University of Granma, Cuba, while the sample consisted of 54 professors.

A survey technique was used to collect data. A questionnaire was used as an instrument to assess the development of technology-mediated research

competencies among teachers. This questionnaire included five items evaluated using a Likert scale:

What level of importance do you attribute to the development of research skills in your teaching practice?

How would you evaluate the level you have reached in the development of scientific research processes?

What level of knowledge do you have about technological tools for searching, managing, and analyzing scientific information?

How often do you use technological tools in the different stages of the research process (search, analysis, writing, dissemination)?

To what extent do you think technological tools have contributed to improving your performance in investigative processes?

SPSS software (version 25) was used for data processing. The instrument's reliability was verified using Cronbach's alpha coefficient (α = 0.883), which indicates high internal consistency, exceeding the reference value of 0.7. This result confirms that the questionnaire is reliable for measuring the construct being assessed.

RESULTS

Technology-mediated research skills among university professors integrate the use of digital tools to manage scientific information, apply innovative methodologies, and foster academic collaboration.

Table 2 presents the results regarding the importance teachers place on developing research skills. The findings show that the majority of teachers (51.9%, n=28) have a good level of research skills, followed by 27.8% (n=15) with an average level. Only 18.5% (n=10) reach a high level, while a minimum of 1.9% (n=1) are below average. These data reveal that, although most teachers demonstrate adequate research skills (81.5% combined across average, good, and high levels), there is significant room for improvement, particularly in the average group, which represents more than a quarter of the sample. The low percentage at the lowest level indicates that serious deficiencies are rare in this teaching population.

Table 1. *Importance given to the development of investigative skills*

	Frequency	Percentage	Valid percentage	Cumulative percentage
Below average	1	1.9	1.9	1.9
Half	15	27.8	27.8	29.6
Good	28	51.9	51.9	81.5
High	10	18.5	18.5	100.0
Total	54	100.0	100.0	

Regarding the distribution of levels of technology-mediated research competency among university faculty, significant trends are evident, as shown in Table 2. The findings indicate that the majority are at the "Below Average" level (57.4%), followed by "Mid" (20.4%), and "Good" (16.7%). Only 5.6% are at the "Low" level. The cumulative percentage reveals that 63% of faculty is concentrated in the lower levels ("Low" and "Below Average"), while 83.3% also include the "Mid" level. The total number of cases is reached when the "Good" category is added (100%). These results reveal a significant gap in the mastery of technological competencies related to research,

with more than half of the faculty requiring strengthening skills such as the use of specialized search engines, scientific information management, and the dissemination of results through ICT.

Table 2. *Distribution of levels of technology-mediated research competence among university professors*

Level of competence	Frequency	Percentage (%)	Valid percentage (%)	Cumulative percentage (%)
Low	3	5.6	5.6	5.6
Below average	31	57.4	57.4	63.0
Half	11	20.4	20.4	83.3
Good	9	16.7	16.7	100.0
Total	54	100.0	100.0	—

Table 3 shows the distribution of knowledge levels in technological tools for scientific information management. The results reveal that the majority of university faculty evaluated (61.1%) have a "Below Average" level in technology-mediated research skills, while only 16.7% reach a "Good" level. Meanwhile, 20.4% are at a "Mid" level, and only 1.9% show "Low" performance. These findings reveal a marked difference, with more than 60% of faculty requiring strengthening their research skills supported by digital tools. The low proportion of faculty with consolidated skills (16.7%) also highlights the need to implement training programs that promote the critical and creative use of technologies for research production.

Table 3. *Knowledge of technological tools for the management of scientific information*

Level of competence	Frequency(n)	Percentage (%)	Valid percentage (%)	Cumulative percentage (%)
Low	1	1.9	1.9	1.9
Below average	33	61.1	61.1	63.0
Half	11	20.4	20.4	83.3
Good	9	16.7	16.7	100.0
Total	54	100.0	100.0	—

Regarding the use of technological tools, Table 4 reveals a heterogeneous distribution. The majority of faculty members were at an intermediate level of proficiency, while extreme levels (high and low proficiency) were limited. The findings reveal that 48.1% of respondents displayed an average level of proficiency in the use of these tools, indicating that, although they use them in their research processes, their utilization is suboptimal. On the other hand, 24.1% were below average, showing limited knowledge, while 5.6% displayed a low level, suggesting significant difficulties in integrating technology into their academic work. In contrast, only 20.4% achieved a good level, demonstrating an adequate and productive use of these tools. Finally, only 1.9% achieved a high level, reflecting a widespread lack of advanced proficiency in technologies applied to research.

These findings reveal that, although technological tools are widely used, their effective application in the research field remains a challenge for most. There is a need to implement differentiated training programs based on skill level, with special emphasis on improving the skills of the majority group (intermediate level) and reducing the gap affecting the 29.6% at the lowest levels.

Table 4. *Levels of use of technological tools in research*

Level of competence	Frequency(n)	Percentage (%)	Valid percentage (%)	Cumulative percentage (%)
Low	3	5.6	5.6	5.6
Below average	13	24.1	24.1	29.6
Half	26	48.1	48.1	77.8
Well	11	20.4	20.4	98.1
High	1	1.9	1.9	100.0
Total	54	100.0	100.0	—

Professors' criteria regarding the support of technological tools in their research processes. The findings reveal that the majority of professors (51.9%) consider this support to be "sufficient," followed by 24.1% who rate it as "not sufficient." Meanwhile, 18.5% rate the support as "very sufficient," while only 5.6% perceive it as "insufficient" or "very insufficient." These results indicate that, although more than 70% of researchers (combining "sufficient" and "very sufficient") consider technological resources adequate, there is a significant group (29.6%) who express unmet needs, highlighting opportunities for improvement in access or technological training for research. The distribution reveals that the main challenge lies in the 24.1% who, without reaching an extremely negative assessment, state that the current support does not fully meet their research needs.

DISCUSSION

In line with this research, a study by Paz and Estrada (2022) analyzed the research training of teachers in Honduras. Their findings highlight a positive perception toward university research, which is influenced by the student's entry profile and curricular sequence. The authors point out that the role, profile, and performance of university professors is crucial for the development of research competencies in students. These factors contribute to the acquisition and development of research skills. For their part, Acosta et al. (2024) point out that faculty training in research is essential to train committed and successful students in the generation of quality scientific knowledge with current relevance.

The findings of González-Díaz et al. (2022)

highlight the need for universities to incorporate effective mechanisms to respond to research demands in a constantly changing environment. The authors indicate that universities must evolve toward intelligent, proactive, and decentralized organizations, where research competencies play a key role in driving academic progress and achieving their long-term strategic objectives.

Regarding the level achieved in the development of scientific research processes, Cárdenas et al. (2021) mention a study with professors at a higher education institution in Ecuador. Among the main findings, they highlight that the faculty shows a favorable attitude toward the development of research skills mediated by ICTs. Furthermore, it was evident that this attitude contributes both to improving educational quality and increasing the institution's scientific production.

Along the same lines, Reyes and Oyala (2024) conducted research with Health Sciences faculty, examining various variables, including professional experience, postgraduate training, and access to technological resources. The results show that 70% of faculty demonstrates a satisfactory level of research competency, with particular proficiency in areas such as scientific writing and data processing. Furthermore, the study established a significant correlation between these research competencies and the university institution of assignment, indicating that institutional factors such as teacher training policies and infrastructure availability directly influence the development of these capacities.

Rojas and Méndez (2017) conducted a comparative study at eight universities in the

metropolitan area of Bucaramanga (Colombia). The results show that faculty members exert a significant influence on the formation of research attitudes among students. In contrast, the analysis demonstrates that the social and institutional factors analyzed have a considerably lower impact on this aspect, highlighting the importance of academic leadership in promoting research.

Regarding the level of mastery of technological tools for searching, managing, and analyzing scientific information, the specialized literature agrees in highlighting their critical importance. In this sense, Slade and Downer (2020) argue that the process of retrieving scientific information represents a considerable challenge without basic information skills, such as knowledge of specialized platforms (e.g., academic databases and bibliographic managers) and advanced search techniques. Similarly, Antúnez and Veytia (2020), together with Sim (2021), emphasize the need to develop skills to effectively use these technological tools, as well as the ability to manage existing scientific information, in order to apply it in a useful and relevant way in academic research.

According to findings by Peinado (2023), they mention a study conducted at the Center for Technological Research and Innovation of the National Polytechnic Institute, revealing that postgraduate professionals preferentially use specialized search engines and academic databases as fundamental tools in their research processes. The author also highlights that the efficient use of these tools facilitates the development of solid proposals and encourages the dissemination of innovative knowledge in the academic field. These findings are consistent with the results of this study.

As Codina (2020) points out, the use of specialized tools for managing scientific information is essential, as it allows access to academic literature that meets three essential criteria: relevance, pertinence, and reliability. This author emphasizes the value of scientific databases, since these platforms incorporate advanced analysis systems, citation-based metrics, and rankings derived from these indicators. In this same context, Antúnez et al. (2022) highlight the usefulness of subject directories, which offer functionalities to refine search results, a capability that not only optimizes the time required for source selection but also facilitates the expeditious identification of the most up-to-date documents in each area of knowledge.

This study coincides with the findings of Cabrera and Antúnez (2021), which identified the main technological tools used for scientific information management by graduate students at the Salomé Ureña Higher Institute for Teacher Training (ISFODOSU) in the Dominican Republic. The results demonstrate that students use these tools efficiently in their academic activities. It is noteworthy that 98.17% of participants use specialized internet tools, which not only facilitates their access to relevant scientific literature but also contributes significantly to strengthening their research processes.

Rodríguez et al. (2016) stated HYPERLINK "http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1990-86442020000200108" \l "B16": scientific research relies on information management as a fundamental aspect of its development. They describe information management as a set of techniques and procedures; it is the methodology for beginning the path of knowledge and is closely related to scientific research and, currently, to the efficient use of specialized tools for information management.

The findings of this study are consistent with the proposals made by Rodríguez et al. (2016) regarding the fundamental role of information management in scientific research. This management is not merely a set of procedural techniques for initiating knowledge generation, but rather represents a strategic component that requires the effective use of specialized tools. As the authors point out, research effectiveness critically depends on the ability to systematically manage and analyze data, a crucial aspect for ensuring both the methodological quality and reproducibility of findings.

Regarding the frequency of use of technological tools in the different stages of the research process, Pazmiño et al. (2018) analyzed 38 Ecuadorian research professors. Their results show that ICTs are predominantly used in the

initial phases (bibliographic search and data collection), while their use to communicate results is significantly lower. This disparity reveals a gap in technological integration throughout the research cycle. As a determining factor, the authors identified insufficient training in advanced digital tools. Therefore, they recommend implementing training programs that cover all stages, from methodological design to final dissemination.

As noted by Artavia and Castro (2024), the search, analysis, and efficient use of information are essential skills inherent to scientific activity. Therefore, to achieve this goal, it is essential that teachers master both digital and research skills. This includes learning not only to select relevant information but also to organize it appropriately, employ advanced digital tools for analysis, and actively participate in collaborative research groups, thus strengthening interdisciplinary work and knowledge production.

It is agreed with Reyes et al. (2020) in affirming the need to develop strategies aimed at strengthening both the knowledge and use of technological tools, so that these become a habit in the research process of university students at the Technical University of Cotopaxi, Ecuador. They also highlight the importance of reinforcing the training of teachers and students, so that they acquire the necessary skills in the use of information technology tools, which, in turn, will contribute to consolidating the research culture.

In agreement with George and Salado (2019), technological tools in research processes are essential to optimize data collection, analysis, and interpretation. These resources allow researchers to achieve greater efficiency by facilitating online collaboration, information organization, and access to specialized databases, in addition to promoting fundamental digital skills in the academic field. Thus, their strategic integration strengthens methodological quality and fosters an innovative and collaborative scientific culture. This perspective is reinforced by Slade and Downer (2020), who argue that digital tools for research offer unique opportunities to develop key competencies, both for academic advancement and for effective participation in professional research environments.

Paz et al. (2015) report on the experience of a diploma program in the Pedagogical Appropriation of ICTs, which focused on strengthening research skills through these tools. Their findings highlight a positive attitude among teachers toward ICTs and their potential to enrich research processes. However, they identify resistance associated with a lack of training and technological knowledge. These results coincide with this study, which highlights the advantages of ICTs in accessing information, collaboration, and data analysis, significantly transforming traditional research dynamics.

According to the findings of Cárdenas et al. (2021), the development of ICT-mediated research competencies, framed within a techno-research approach, involves several essential evaluation criteria. Among these, the clear and substantiated identification of the problem in the field of scientific research stands out, using technological tools as support. Likewise, it is essential to redefine experience in the research field, while comprehensively addressing professional situations and generalizing the results obtained. These capacities must be fully developed in the full performance of university professors, which fosters a research culture characterized by innovation and collaboration in the educational context.

CONCLUSIONS

The study revealed that, although 70.4% of faculty members possess good or high levels of research skills, their performance in the use of technology is limited: 57.4% are below average in ICT-mediated research, and only 16.7% are proficient in using digital tools. This disparity is exacerbated when analyzing the specific use of technology, with 48.1% at an intermediate level and 24.1% at a basic level, which limits their ability to implement research processes that meet current demands.

It is confirmed that, while the use of technological tools is concentrated primarily at the Mid (48.1%) and Good (20.4%) levels, a significant percentage of teachers persist at the "Below Average" level (24.1%). This distribution reveals two priority challenges: on the one hand, the need to optimize access to technological

resources and, on the other, the urgent need to strengthen training programs in tools for managing scientific information, especially aimed at the group with lower digital skills.

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