

Research competencies in Peruvian higher education: a mixed-methods evaluation

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ABSTRACT

Research participation among Peruvian university students remains low, which limits the systematic development of research competencies needed for academic and professional training. This review identifies effective pedagogical strategies to strengthen research skills in Peruvian higher education and compares them with international trends. Following preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines, we analyzed 52 peer-reviewed studies published between 2017 and 2024. The evidence shows that flipped learning, collaborative learning, research workshops and seedbeds, project-based learning (PBL), and academic mentoring consistently improve students' research competencies, including critical thinking, methodological rigor, and scientific communication. These approaches also increase autonomy, engagement, and sustained work on authentic research problems. Overall, student-centered and practice-oriented strategies can strengthen research training and support a sustainable research culture in Peruvian universities.

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1. INTRODUCTION

Despite the regulatory framework established by University Law No. 30220, which defines research as a core function of higher education in Peru, student participation in research activities remains limited [1]. Recent evidence indicates that only 12% of Peruvian university students actively engage in research during their academic training, restricting the systematic development of research competencies essential for academic performance, professional practice, and national innovation [2]. This low level of participation constrains students' ability to critically formulate problems, design rigorous methodologies, and contribute meaningfully to knowledge production, thereby widening the gap between institutional research mandates and actual educational practice [3]. In this context, strengthening research skills at undergraduate level is essential for improving problem-solving abilities, knowledge generation and critical analysis of reality [4]. This need is based on UNESCO's approach, which views research skills as an essential component of higher education, promoting a culture of research in which students actively participate in the construction of knowledge and develop critical thinking and academic autonomy [5]–[7]. This concept is reinforced by Bandura's social cognitive theory, which explains that complex skills, such as research skills, are developed through the interaction of cognitive, social and motivational factors, through active participation, observation and guided practice [8]. From this perspective, inquiry-based learning is not limited to the transmission of content, but is built on experience and interaction with the academic environment [9]. Taken together, these approaches support the argument that the development of research skills at the undergraduate level requires

student-centered and practice-oriented teaching strategies that promote the appropriate selection of methodologies, critical interpretation of results, and respect for ethical principles in scientific communication [10], [11]. Thus, their effective integration strengthens students' ability to tackle complex problems in their professional field and project themselves as future researchers and leaders in their discipline [12].

Several studies in Peru describe concrete strategies that strengthen research competencies in university students. For example, Castro-Rodríguez [13] reported positive outcomes from research groups, collaborative work, problem-based learning, case studies, essay writing, project-based methods, seminars, workshops, summer programs, and research internships supported by advisors. In a controlled study at the Santiago Antúnez de Mayolo National University, Park [14] showed that cooperative learning improved performance levels compared with a control group, indicating a meaningful contribution to research skill development. Similarly, Böttcher and Thiel [15] analyzed 215 students from the University of Huánuco and found that quantitative and conceptual-epistemological teaching approaches influenced research skill development. Students demonstrated methodological mastery by solving problems and developing theoretical proposals with innovative potential. In nursing education, Nácher *et al.* [16] observed improvements after inquiry-based activities, with a substantial proportion of students reaching full development of research skills. By contrast, other research [17], [18] reported that many students still showed only moderate research skill development, even when participating in research groups and dedicating time to these activities. Overall, the Peruvian evidence highlights the value of practical tasks, collaboration, and sustained guidance in undergraduate research training.

International studies also support the use of innovative strategies to build research competencies. In Cuba, Labrador-Falero *et al.* [19] used digital newsletters and training workshops in dentistry to reinforce research knowledge and align outputs with professional profiles. Another study by Cutillas *et al.* [20] strengthened students' capacity to interpret and solve research problems through a Web 3.0 tool, showing clear improvement after the intervention. In a supervised experience involving 419 students, Ahmad and Al-Thani [21] promoted research-related skills through guided activities that supported academic presentations, posters, and papers. In Sucre, previous research [22], [23] emphasized formative research as a mechanism for inquiry, knowledge construction, and practical application. Several studies highlighted the importance of curricular and institutional support for sustained research training [24], [25]. In Mexico, Mansoori [26] implemented a Drive-based virtual environment in three universities, supporting projects, theses, and academic content production while facilitating collaborative work and academic standards such as American Psychological Association (APA). The "mirror class" strategy by Panadero *et al.* [27] supported reflection on teaching practice through observation tools and audiovisual records, contributing to improved pedagogical dynamics. In Colombia, Vera-Pirela and Galvis-Núñez [28] found that deficiencies in technical competencies and research attitudes could undermine thesis completion and professional prospects. In Ecuador, Taylor *et al.* [29] documented a shift from teacher-centered teaching to collaborative and project-based approaches through a Knowledge Integration Project, which increased participation and methodological adaptation. Finally, Lyon *et al.* [30] highlighted the role of information and communication technology (ICT) in research training by supporting digital resource management, critical evaluation, and information analysis. Together, these experiences show that research competencies improve when students work on authentic projects, receive structured feedback, collaborate meaningfully, and learn within supportive institutional environments.

In this context, the present study conducts a systematic review of recent literature on the development of research competencies in undergraduate students. The aim is to identify the most effective pedagogical strategies implemented in Peruvian higher education and to compare them with international trends. Specifically, this review seeks to answer the following research question: which pedagogical strategies have proven most effective in developing research competencies among undergraduate university students in the Peruvian higher education context?

2. METHOD

Before beginning the search, inclusion and exclusion criteria were defined in order to ensure consistency, methodological rigor, and thematic relevance in the selection of studies. In general terms, research was included that: i) was peer-reviewed scientific articles; ii) was published between 2017 and 2024; iii) were available in full text and in Spanish or English; and iv) explicitly addressed the development, promotion, or evaluation of research skills/competencies in undergraduate university students, including strategies, methods, or educational experiences aimed at strengthening these competencies.

Studies were excluded if they: i) were published before 2017; ii) were non-refereed products (theses, books, chapters, or other non-peer-reviewed documents); iii) were not available in full text or were not in Spanish/English; iv) focused on other educational levels or populations (e.g., secondary school, postgraduate,

teachers, and graduates); or v) did not address the development of research competencies from an educational perspective (e.g., measurement of institutional scientific output without intervention/training). Table 1 presents the operational details of these criteria.

Next, the identification, selection, and inclusion of studies was carried out following the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines, which consist of four phases: identification, screening, eligibility assessment, and final inclusion. In the identification phase, 578 records were retrieved from four academic databases: Scopus (n=38), PubMed (n=4), Google Scholar (n=416), and ScienceDirect (n=120), applying the defined bibliographic filters (period 2017–2024, peer-reviewed articles and Spanish/English language). Subsequently, 126 duplicate records were eliminated, leaving 452 unique references for analysis.

In the screening phase, the titles were reviewed to determine their relevance to the study objective, which led to the exclusion of 270 records. As a result, 182 studies were reviewed for abstracts. Analysis of the abstracts led to the exclusion of 110 articles that did not meet the established criteria, mainly because they did not focus on undergraduate students or did not address the development of research skills through educational strategies, methods, or experiences. Thus, 72 studies were identified as potentially eligible.

The 72 preselected articles were considered for full-text review; however, five could not be retrieved, so 67 articles were evaluated in their entirety. In the eligibility phase (full text), compliance with the previously defined inclusion and exclusion criteria, as shown in Table 1 was verified, excluding those studies that, despite passing the screening, did not fully meet these criteria. As a result, 15 articles were excluded, and 52 studies were finally included in the systematic review. The entire selection process is summarized in Figure 1 using the PRISMA flow diagram, which details the number of records identified, excluded, and retained in each phase.

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Publications between 2017 and 2024 (last 8 years).	Publications prior to 2017.
Peer-reviewed academic articles (scientific journals).	Theses, books, chapters, or other non-refereed documents.
Studies available in full text, in Spanish or English.	Studies in languages not handled (e.g., Portuguese) or without access to full text.
Research focused on developing research skills in undergraduate students (higher education).	Research focused on students at other educational levels (secondary school, postgraduate) or on different subjects (teachers, graduates).
Studies addressing educational strategies, methods, or experiences to promote or evaluate research skills.	Studies not related to the development of research skills (e.g., those that only measure institutional scientific output, without an educational focus).
Studies conducted in Latin American and international contexts, without restriction by country of origin, provided they met the other established criteria.	Studies with no theoretical or empirical relevance for the analysis of the Peruvian educational reality.

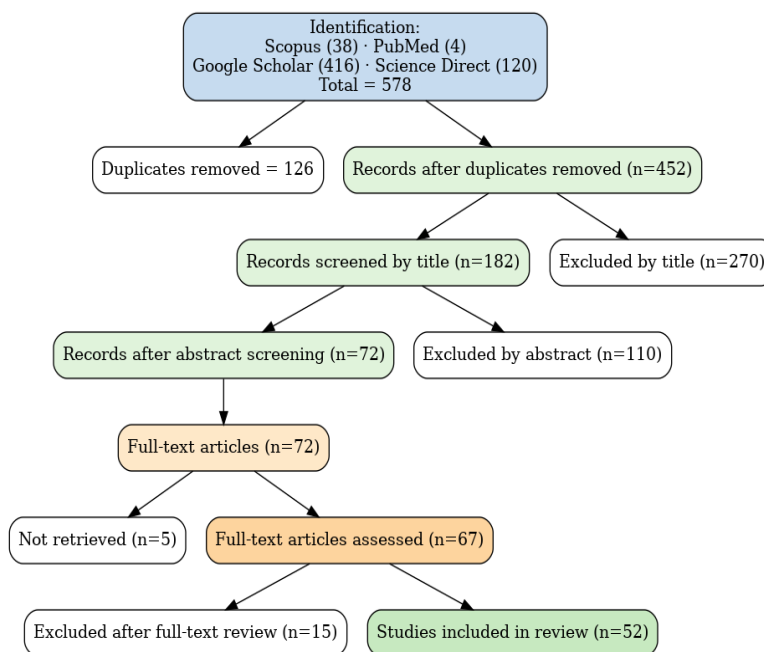


Figure 1. PRISMA flow diagram of the study selection process

No formal critical appraisal tool (e.g., CASP or JBI) was applied in this review. However, during the full-text eligibility assessment, methodological robustness was considered as part of the selection process. This appraisal included evaluating the clarity of research objectives, the coherence between aims, methods, and outcomes, and the appropriateness of the analytical procedures. These criteria informed both the final inclusion of studies and the interpretation of the findings. With the 52 studies included, data extraction and a thematic synthesis were carried out, allowing the pedagogical strategies identified to be grouped into categories of analysis, which are presented and developed in the results section.

3. RESULTS

Based on the 52 studies analyzed, various pedagogical strategies were identified that have been used to develop research skills in higher education students. The findings were grouped into eight main thematic categories: i) flipped learning; ii) Lean Startup methodology; iii) collaborative learning; iv) research seedbeds and workshops; v) active participation in projects and mentoring; vi) project-based learning (PBL); vii) comprehensive teaching strategies; and viii) use of assessment rubrics. Each category merging similar findings and eliminating redundancies, and illustrating with notable examples from the literature.

3.1. Flipped learning

Flipped learning strengthened research competencies by relocating theoretical input to pre-class study and reserving in-class time for application, discussion, and feedback. Across the reviewed evidence, students arrived more prepared and engaged, which translated into gains throughout the research process from problem identification to dissemination of results [31]. Likewise, the structured use of recorded lessons and pre-class materials increased cognitive and emotional engagement and improved performance in literature review and the formulation of precise research questions [32]. However, these benefits depended on the quality and accessibility of the resources provided for autonomous preparation, making instructional design a key condition for effectiveness [33].

3.2. Lean Startup methodology

Lean Startup-based training promoted research skills through rapid experimentation, continuous feedback, and iterative refinement (build-measure-learn). In the studies reviewed, students adopted a more proactive inquiry stance by designing pilot studies, evaluating outcomes early, and improving decisions based on evidence and error analysis [34], [35]. This approach supported an “entrepreneurial researcher mindset” characterized by contextual adaptation, innovation, and feasibility-oriented planning, aligning research training with real-world problem solving. Complementary evidence suggests that integrating lean principles encourages creativity and continuous improvement habits, reinforcing applied critical thinking and iterative methodological refinement [36], [37].

3.3. Collaborative learning

Collaborative learning enhanced research performance by leveraging peer interaction, shared goals, and social scaffolding to resolve conceptual and methodological challenges. Empirical evidence reported deeper understanding of scientific methodology, stronger analytical skills, and observable progress in research competencies through idea exchange and peer learning [38]. Framed within socio-constructivist theory, structured collaboration supported students within their zone of proximal development, improving question formulation, increasing rigor in data collection, and fostering a more critical stance toward results [39], [40]. Overall, collaborative structures consistently reinforced scientific communication, coordination, and co-creation of solutions as core components of research training.

3.4. Seedbeds and research workshops

Research seedbeds and workshops consolidated research skills by creating communities of practice where students learned research through sustained, guided participation in authentic projects. Evidence from vocational and disciplinary contexts indicates that seedbeds enabled students to translate classroom concepts into concrete inquiry tasks collecting evidence, discussing findings, and building reflective habits typical of research work [41]. Similarly, structured workshop dynamics helped students develop problem identification and causal analysis skills, while promoting responsibility distribution and leadership within teams [42]. Collectively, these settings functioned as a bridge between theory and practice, strengthening hypothesis formulation, collaborative inquiry routines, and scientific communication in early-stage researchers.

3.5. Participation in research projects and mentoring

Active participation in real research projects improved research competencies by immersing students in authentic methodological decision-making and reflective practice. In action-research contexts, students developed critical analysis, methodological innovation, and practical skills in instrument use, data collection, and analysis while addressing real problems [43], [44]. Complementarily, faculty mentoring amplified these gains through continuous feedback across the full thesis cycle—design, execution, writing, and dissemination—supporting disciplined research habits (time management, documentation rigor) and strengthening problem formulation, methodological planning, and academic writing [45]. Together, project immersion and mentoring operate as synergistic mechanisms: practice builds competence, while expert guidance stabilizes quality and accelerates learning.

3.6. Project-based learning

PBL reinforced research skills by positioning students as active problem-solvers who develop and present evidence-based solutions over time. Reported outcomes included increases in multiple performance indicators when learners selected topics aligned with their interests and received periodic supervision across all phases from question formulation to results presentation [46]. This sustained facilitation strengthened information literacy (searching reliable sources), integration of theory with practice, and deeper learning through iterative project development. Additional evidence suggests PBL also cultivates research-relevant attitudes such as curiosity, persistence, and constructive self-criticism, while promoting teamwork, problem solving, and communication [47].

3.7. Comprehensive teaching strategies

Multi-method teaching strategies produced broad improvements in research competencies by combining tutoring, individual advising, ICT use, and staged practical exercises within a coherent learning sequence. In the reviewed case, students improved research planning, organization, and scientific language, alongside stronger methodological execution (objective setting, design selection, rigorous analysis, and defensible conclusions) when guided through a structured mixed approach [48]. Similarly, combining expository, participatory, and evaluative methods supported both conceptual and attitudinal dimensions of research training, facilitating ethical reflection, academic integrity, and critical engagement with complex problems [49]. These findings indicate that the strategic integration of complementary methods not a single technique tends to generate the most holistic development of research competencies.

3.8. Use of assessment rubrics

Analytical rubrics strengthened research competencies by clarifying performance standards and enabling repeated, criterion-based feedback across key research tasks. In law education, detailed rubrics aligned with competencies such as bibliographic search, objective and hypothesis formulation, problem delimitation, theoretical framework development, method selection, interpretation of results, and formal writing standards supported measurable progress and improved critical thinking through structured feedback cycles [50]. Additionally, rubric validation studies emphasize the value of standardized instruments for reliably monitoring competency development over time [51]. Overall, research-focused rubrics offer both instructional and evaluative advantages: they guide student effort toward quality benchmarks while enabling transparent and consistent assessment aligned with higher education competency goals.

Table 2 (see Appendix) summarizes the main results of the review, highlighting the most relevant pedagogical strategies for strengthening research skills. Firstly, flipped learning fosters students' autonomy and deep learning; in turn, the Lean Startup methodology encourages innovation and resilience in research projects. Likewise, collaborative learning enhances the co-construction of knowledge and social skills, while research seedbeds and workshops reinforce motivation and the academic culture. Complementarily, participation in real projects with mentoring ensures the consolidation of research habits, and PBL increases student motivation and commitment. Moreover, comprehensive teaching strategies make it possible to address the diversity of learning styles, and the use of assessment rubrics guides self-evaluation and continuous improvement. Taken together, these approaches comprehensively strengthen research training and ensure more meaningful and lasting learning.

4. DISCUSSION

The results of this systematic review indicate that the development of research skills in Peruvian higher education is enhanced by the implementation of active, collaborative, and practice-oriented teaching strategies [52], [53]. This finding is consistent with international evidence, suggesting that there are shared pedagogical principles that transcend contextual differences and explain the effectiveness of such strategies in university research training [54]–[56]. From a theoretical perspective, this coincidence can be interpreted

in light of social cognitive theory, as active strategies promote research self-efficacy through direct student participation, observation of academic models, and continuous feedback, factors that have been shown to be decisive in the learning of complex skills [8].

However, a more detailed analysis of the differences between the Peruvian and international contexts shows that, although the methodologies used are similar, such as collaborative learning, research seedbeds, formative inquiry, and PBL, their impact has relevant nuances [13], [15]–[17]. In several international studies, these strategies are systematically integrated into the curriculum and supported by stable institutional policies, which favors continuous processes of academic support and scaffolding [19], [20], [25]. In contrast, in the Peruvian context, their implementation often depends on isolated initiatives or the individual commitment of teachers, which limits their sustainability and continuity [52]. From Vygotsky's socioconstructivist approach, this difference is key, as the absence of solid institutional structures reduces opportunities for prolonged interaction and social scaffolding within the zone of proximal development, affecting the progressive consolidation of research skills [40]. Overall, the findings analyzed show that, although Peru shares similar pedagogical approaches to those used in other international contexts, differences in their institutional implementation have a decisive influence on the consolidation of research skills, reinforcing the need to understand research training from a contextual and theoretically grounded perspective.

Despite the consistency of the findings, this review has some limitations that should be considered when interpreting the results. First, reliance on published studies may have introduced publication bias, as research with favorable results tends to be disseminated more frequently. Second, the review was restricted to articles published in Spanish and English, which may have excluded relevant evidence developed in other languages. Furthermore, the methodological heterogeneity of the included studies in terms of designs, sample sizes, and assessment instruments limits the possibility of making direct quantitative comparisons between the Peruvian and international contexts. However, these limitations do not invalidate the results obtained, but rather delimit their scope and highlight the need for future research with more homogeneous designs and broader comparative approaches.

5. CONCLUSION

The implementation of innovative educational strategies has been shown to strengthen university students' research skills, promoting autonomy, active learning, and key skills such as problem formulation, methodological design, data analysis, and scientific communication. These methodologies contribute to consolidating a culture of research within higher education and prepare students to face the academic and professional challenges of the 21st century. Universities should integrate methodologies such as the flipped classroom, PBL, collaborative workshops, research seedbeds, and academic tutoring, supported by educational technologies and standardized rubrics. This will allow students to actively participate in the construction of knowledge and develop critical thinking and academic autonomy. Education policymakers should encourage the creation of research incubators, mentoring programmers, and the incorporation of emerging digital tools, such as artificial intelligence, virtual reality, and data analysis platforms, to enrich research training and ensure the development of competent and ethical professionals. Future studies should explore the longitudinal impacts of these strategies on academic and professional trajectories, evaluate their effectiveness in different disciplines and institutional contexts, and analyze possible synergies between combined methodologies. In addition, it is advisable to design more robust assessment tools that allow for the objective measurement of progress in research skills. These actions will contribute to consolidating a more innovative, inclusive, and effective higher education system, capable of training professionals and researchers who respond with creativity, rigor, and ethics to the challenges of knowledge and sustainable development in the country.

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C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY

No new data were created or analyzed in this study. Data sharing is not applicable.

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APPENDIX




Table 2. Summary of identified strategies, representative sources, and key findings

Strategy	Key findings	Impact on research skills
Flipped learning	Comprehensive improvement of research skills (problem identification, literature review, data analysis, presentation of results). Increases student preparation and active participation, promoting autonomous and in-depth learning. Requires prior quality resources to maximize its impact.	Promotes a comprehensive development of research skills, including problem identification, literature review, data analysis, and presentation of results. Encourages student autonomy, prior preparation, active participation, and deeper learning. Its effectiveness depends on the availability of high-quality instructional resources.
Lean Startup methodology	It fosters dynamic and iterative attitudes in students through the build-measure-learn cycle. It promotes innovation, learning from mistakes, and continuous improvement in research projects. It contributes to training resilient, adaptable, and practice-oriented students with an entrepreneurial mindset in research.	Strengthens innovation, adaptability, and resilience in the research process through iterative experimentation (build-measure-learn). Encourages learning from errors, continuous improvement, and the development of an entrepreneurial mindset applied to research.
Collaborative learning	Strengthens research skills through social interaction and the co-construction of knowledge. Improves methodological understanding, critical analysis, and problem solving through peer support and mutual scaffolding. Reinforces social skills (communication, teamwork) that are important in group research.	Enhances research skills through social interaction and the co-construction of knowledge. Improves methodological understanding, critical analysis, and problem-solving abilities while reinforcing communication, teamwork, and peer-supported learning.
Seedbeds and research workshops	Extracurricular or curricular spaces where students apply theory to real projects with faculty guidance. They facilitate knowledge integration, critical debate, and leadership development. They contribute to an institutional research culture, increasing student motivation and retention in research activities.	Provide structured spaces where students apply theoretical knowledge to real research projects. Foster research habits, leadership, critical debate, and motivation, while contributing to the consolidation of an institutional research culture.
Participation in projects and mentoring	The direct involvement of students in real research projects strengthens skills such as analysis, methodological innovation, and practical problem solving. Constant academic mentoring ensures timely feedback, consolidation of research habits, and correct application of the scientific method. Together, these strategies prepare students for larger-scale research and provide pre-professional experience.	Strengthens methodological rigor, analytical thinking, and practical problem-solving through direct involvement in real research contexts. Personalized mentoring ensures continuous feedback, consolidation of research habits, and correct application of the scientific method.
PBL	Increases motivation and commitment by focusing learning on meaningful projects chosen by the students themselves. Develops research skills step by step: asking questions, methodological design, data collection, analysis, and presentation of results. Teacher supervision during the process is crucial for success. Effectively integrates theory and practice, achieving lasting learning.	Increases motivation and commitment by engaging students in meaningful, student-centered research projects. Develops research skills progressively, from question formulation to data analysis and dissemination of results, effectively integrating theory and practice.
Comprehensive teaching strategies	The combination of multiple methods (group and individual tutorials, ICT, debates, and laboratories) enhances different aspects of research skills. It improves technical skills (planning, use of tools, scientific language) as well as reflective and attitudinal skills (critical thinking, ethics, perseverance). It allows for a diversity of learning styles to be addressed and builds a more comprehensive research education.	Promote holistic development of research skills by combining multiple pedagogical approaches. Enhance technical, reflective, ethical, and attitudinal competencies while addressing diverse learning styles and fostering deeper understanding of the research process.
Use of assessment rubrics	It guides learning by specifying performance criteria in research skills. It facilitates the objective assessment of skills such as problem formulation, information search, critical analysis, and academic communication. Feedback through rubrics improves critical thinking and the quality of work. It also promotes a culture of self-assessment and continuous improvement among students.	Guides the development of research skills by clearly defining performance criteria. Facilitates objective assessment, self-regulation, and continuous improvement in areas such as critical analysis, academic writing, and methodological accuracy.

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