

***The Effect of Research-Based Learning on University Students' Research Skills
and Academic Performance***

*El efecto del Aprendizaje Basado en la Investigación en las habilidades
investigativas y el rendimiento académico de estudiantes universitarios*

*L'effetto dell'Apprendimento Basato sulla Ricerca sulle competenze di ricerca e sul
rendimento accademico degli studenti universitari*

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Artículo de investigación

* **Recibido:** 15-09-2026 * **Aceptado:** 05-10-2026 * **Publicado:** 05-10-2026

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Abstract

This study examined the effect of Research-Based Learning on university students' research skills and academic performance within a research-related course. A quantitative quasi-experimental pre-test and post-test design was employed with university students enrolled in a subject focused on research methodology and scientific inquiry. Data were collected using a Research Skills Assessment Questionnaire and course-based academic performance records. The intervention incorporated Research-Based Learning activities in which students identified research problems, formulated research questions and objectives, reviewed scientific literature, selected methodological procedures, collected and analyzed data, and communicated research findings. Results showed an increase in the overall research skills mean from 2.67 in the pre-test to 4.09 in the post-test, indicating a shift from a moderate to a high level of research competence. Improvement was observed across all eight evaluated criteria, with the greatest gains in academic writing and presentation of findings, as well as data analysis and interpretation. The findings suggest that Research-Based Learning can contribute to the development of research competencies by promoting active engagement with the different stages of the research process. The study supports the integration of research-oriented instructional strategies into university research courses to strengthen students' methodological knowledge, practical research abilities, and academic development.

Keywords: Research-Based Learning, research skills, academic performance, university students, research competence, higher education.

Resumen

El presente estudio analizó el efecto del Aprendizaje Basado en la Investigación sobre las habilidades investigativas y el rendimiento académico de estudiantes universitarios matriculados en una asignatura relacionada con la investigación. Se empleó un enfoque cuantitativo con un diseño cuasiexperimental de pretest y postest. La recolección de datos se realizó mediante un Cuestionario de Evaluación de Habilidades Investigativas y los registros de rendimiento académico correspondientes a la asignatura. La intervención incorporó actividades de Aprendizaje Basado en la Investigación en las que los estudiantes identificaron problemas de investigación, formularon preguntas y objetivos, revisaron literatura científica, seleccionaron procedimientos metodológicos, recopilaron y analizaron datos y comunicaron los resultados obtenidos. Los resultados evidenciaron un incremento en la media global de las habilidades investigativas, que pasó de 2,67 en el pretest a 4,09 en el postest, lo que representó un cambio de un nivel moderado a un nivel alto de competencia investigativa. Se observaron mejoras en los ocho criterios evaluados, destacándose principalmente la escritura académica y presentación de resultados, así como el análisis e interpretación de datos. Los hallazgos sugieren que el Aprendizaje Basado en la Investigación puede contribuir al fortalecimiento de las competencias investigativas al promover una participación activa de los estudiantes en las diferentes etapas del

proceso de investigación. El estudio respalda la incorporación de estrategias de enseñanza orientadas a la investigación en asignaturas universitarias, con el propósito de fortalecer los conocimientos metodológicos, las habilidades prácticas de investigación y el desarrollo académico de los estudiantes.

Palabras clave: Aprendizaje Basado en la Investigación, habilidades investigativas, rendimiento académico, estudiantes universitarios, competencia investigativa, educación superior.

Riassunto

Il presente studio ha analizzato l'effetto dell'Apprendimento Basato sulla Ricerca sulle competenze di ricerca e sul rendimento accademico di studenti universitari iscritti a un corso relativo alla metodologia della ricerca. È stato adottato un approccio quantitativo con un disegno quasi-sperimentale pre-test e post-test. I dati sono stati raccolti mediante un Questionario di Valutazione delle Competenze di Ricerca e attraverso i registri del rendimento accademico relativi al corso. L'intervento ha integrato attività di Apprendimento Basato sulla Ricerca nelle quali gli studenti hanno identificato problemi di ricerca, formulato domande e obiettivi, esaminato la letteratura scientifica, selezionato procedure metodologiche, raccolto e analizzato dati e comunicato i risultati ottenuti. I risultati hanno evidenziato un aumento della media complessiva delle competenze di ricerca, passata da 2,67 nel pre-test a 4,09 nel post-test, indicando un cambiamento da un livello moderato a un livello elevato di competenza investigativa. Sono stati osservati miglioramenti in tutti gli otto criteri valutati, con progressi particolarmente rilevanti nella scrittura accademica e nella presentazione dei risultati, nonché nell'analisi e interpretazione dei dati. I risultati suggeriscono che l'Apprendimento Basato sulla Ricerca può contribuire allo sviluppo delle competenze investigative promuovendo il coinvolgimento attivo degli studenti nelle diverse fasi del processo di ricerca. Lo studio sostiene l'integrazione di strategie didattiche orientate alla ricerca nei corsi universitari, al fine di rafforzare le conoscenze metodologiche, le abilità pratiche di ricerca e lo sviluppo accademico degli studenti.

Parole chiave: Apprendimento Basato sulla Ricerca, competenze di ricerca, rendimento accademico, studenti universitari, competenza investigativa, istruzione superiore.

Introduction

Higher education institutions are increasingly expected to prepare students not only to acquire disciplinary knowledge but also to investigate problems, evaluate evidence, interpret data, and generate knowledge through systematic inquiry. Within this context, research skills have become an important component of university education because they enable students to identify relevant problems, formulate research questions, review scientific literature, select appropriate methodological procedures, collect and analyze data, and communicate findings effectively. These abilities are relevant not only for students who intend to pursue academic careers but also for graduates who are expected to make evidence-informed decisions in professional environments. Vieno et al. (2022) identify critical appraisal, information synthesis, decision making, problem solving, data collection, data analysis, and communication among the principal research skills applicable across undergraduate and postgraduate programs.

Despite the relevance of these competencies, university students often experience difficulties when research is taught primarily through theoretical explanations of concepts, methodological terminology, and isolated academic exercises. Understanding concepts such as variables, hypotheses, research designs, sampling, data collection, and statistical analysis does not necessarily imply that students are able to apply them independently in an authentic research process. Consequently, higher education requires instructional approaches that provide students with opportunities to use research procedures rather than merely learn about them. Research-Based Learning (RBL) represents one such approach, as it integrates research activities directly into the teaching-learning process and positions students as active participants in the construction of knowledge.

Research-Based Learning can be understood as a student-centered educational approach in which learners engage actively with different stages of the research process. Rather than receiving knowledge exclusively from the instructor, students investigate questions, consult scientific literature, formulate research problems, design methodological procedures, collect or analyze evidence, interpret results, and communicate conclusions. This approach connects teaching and research by allowing students to experience practices similar to those used by researchers. Recent reviews describe RBL as an approach strongly associated with active inquiry, problem solving, autonomous learning, critical thinking, and the development of research-related competencies.

The theoretical foundation of RBL is closely connected to constructivist and experiential perspectives on learning. From this perspective, knowledge is developed through active engagement, reflection, interaction, and the application of concepts to meaningful situations. In research-oriented university courses, students are therefore expected to learn research more effectively when they participate directly in research activities. For example, identifying a research problem requires learners to distinguish between broad topics and researchable questions; reviewing previous studies requires them to search, evaluate, compare, and synthesize

information; and analyzing collected data requires the application of methodological and statistical knowledge. Such activities transform abstract methodological concepts into observable academic practices.

Empirical evidence increasingly supports the contribution of RBL to the development of research competencies. Wessels et al. (2021), in a pre-post investigation involving 952 students enrolled in 70 research-based learning courses across ten German universities, examined changes in research-related cognitive and affective dispositions. Their work demonstrates the importance of evaluating RBL through measurable student outcomes rather than assuming that participation in research automatically results in competence development. Similarly, Uaciquete and Valcke (2022) employed a quasi-experimental crossover design to compare research-based and research-led learning among undergraduate students. Their findings indicated a significantly stronger effect on research competence when students were exposed to the RBL condition earlier in the intervention, providing additional evidence that active participation in research can contribute to measurable competence development.

More recent longitudinal evidence provides further support for this relationship. Thiem et al. (2023) examined panel data from 520 university students across 53 study programs and investigated changes occurring before and after participation in research-based learning. Their findings revealed significant improvements in students' self-rated research competencies, particularly in reviewing existing research, understanding methodology, reflecting on findings, communicating results, and developing content knowledge. Importantly, the study included students from multiple academic disciplines, strengthening the argument that the potential benefits of RBL are not restricted to a single field of study.

Research skills themselves represent a multidimensional construct. They involve more than the ability to produce a research paper or understand methodological terminology. Vieno et al. (2022) emphasize that research competence encompasses skills including critical appraisal, information synthesis, problem solving, decision making, data collection, data analysis, and communication. Consequently, assessing the effectiveness of RBL requires attention to several dimensions of students' ability to perform research. In a quantitative study, these competencies can be operationalized through instruments that measure students' ability to formulate research problems and questions, identify appropriate methodological designs, locate and evaluate academic information, collect and analyze data, interpret findings, and communicate research results.

In addition to its potential influence on research skills, RBL may contribute to students' broader academic performance. Engaging in research requires learners to connect theoretical concepts with practical situations, analyze information critically, solve problems, collaborate, and make evidence-based decisions. These cognitive processes may reinforce disciplinary understanding and contribute to achievement in academic courses. Previous experimental research with undergraduate students has reported differences in course achievement and specific

research-skill dimensions according to the type and structure of research-based learning experienced by students. Nevertheless, improvements in research competence should not automatically be interpreted as improvements in all indicators of academic achievement.

This distinction is particularly important because evidence concerning academic performance remains less consistent than evidence concerning research competencies. For example, recent research involving undergraduate medical students found that students who participated in research training demonstrated stronger scientific literature reading, data analysis, scientific writing, and medical English performance than those without such training, while no significant difference was identified in overall grade point average. These results suggest that research experiences may produce stronger effects on specific skills and course-related outcomes than on broad indicators of academic achievement. Therefore, research skills and academic performance should be examined as related but distinct dependent variables.

Recent studies continue to highlight the educational relevance of integrating research activities into higher education. Cabezas Reyes et al. (2025), for example, examined research-based learning among 400 university students and identified positive relationships between research-oriented methodologies, scientific competencies, and students' academic and professional formation. However, much of the existing literature focuses on perceptions, self-reported competencies, specific disciplines, or particular forms of undergraduate research experiences. Additional quantitative research is therefore needed to examine the effect of structured RBL interventions on both demonstrable research skills and measurable academic performance within regular university courses.

Accordingly, the present study aims to determine the effect of Research-Based Learning on university students' research skills and academic performance. The study considers RBL as the independent variable, while research skills and academic performance constitute the principal dependent variables. By quantitatively comparing students' performance before and after exposure to an RBL intervention, and where possible against a comparison condition, the study seeks to provide empirical evidence regarding the effectiveness of integrating authentic research activities into university teaching.

Methodology

Participants

The participants were university students enrolled in a research-related subject during the academic semester in which the study was conducted. All participants were receiving formal instruction in fundamental research concepts, including the identification of research problems, formulation of objectives and hypotheses, literature review procedures, research design, data collection, data analysis, and academic writing. The students participated in regular classroom activities as part of their academic program and were exposed to Research-Based Learning

activities integrated into the subject. These activities required them to apply theoretical research concepts to practical tasks and progressively develop a research project. Participation in the study was based on students' enrollment in the course, and their academic progress and research skills were assessed throughout the intervention.

Instruments

Two main instruments were used to collect quantitative data. First, a Research Skills Assessment Questionnaire was applied to evaluate students' abilities in areas such as identifying research problems, formulating research questions and objectives, locating and evaluating academic sources, selecting appropriate research methods, collecting and analyzing data, interpreting findings, and presenting research results. The instrument consisted of Likert-scale items in which students indicated their level of competence regarding each research skill. It was administered before and after the intervention to identify possible changes in students' research abilities. Second, students' academic performance was measured through their scores in course-related assessments, including research assignments, practical activities, examinations, and the final research project. These scores were obtained from the official assessment records of the subject and were used as quantitative indicators of academic achievement.

Research Design and Procedure

The study followed a quantitative quasi-experimental pre-test and post-test design to determine the effect of Research-Based Learning on students' research skills and academic performance. At the beginning of the study, participants completed the Research Skills Assessment Questionnaire to establish their initial level of research competence. During the intervention, Research-Based Learning was incorporated into the research subject through practical activities in which students identified research problems, searched and reviewed scientific literature, formulated research questions and objectives, selected appropriate methodological approaches, designed data collection instruments, analyzed information, and presented research findings. The instructor acted as a facilitator, providing guidance and feedback throughout the different stages of the research process. At the end of the intervention, the research skills instrument was administered again, and students' academic performance scores were collected. Pre-test and post-test results were then compared through descriptive and inferential statistical analyses to determine whether significant changes occurred in students' research skills and academic achievement after participating in the Research-Based Learning experience.

Results

The effect of Research-Based Learning was analyzed through eight criteria related to students' research skills and academic performance. The research skills were interpreted using

the following scale: 1.00–1.80 = Very Low, 1.81–2.60 = Low, 2.61–3.40 = Moderate, 3.41–4.20 = High, and 4.21–5.00 = Very High.

Table 1. Pre-Test and Post-Test Results According to Eight Evaluation Criteria

Criteria	Pre-Test Mean	Pre-Test Level	Post-Test Mean	Post-Test Level	Difference
Identification of research problems	2.76	Moderate	4.12	High	+1.36
Formulation of research questions	2.68	Moderate	4.08	High	+1.40
Formulation of research objectives	2.72	Moderate	4.15	High	+1.43
Literature search and source selection	2.85	Moderate	4.24	Very High	+1.39
Selection of research methodology	2.54	Low	3.96	High	+1.42
Data collection skills	2.71	Moderate	4.10	High	+1.39
Data analysis and interpretation	2.45	Low	3.89	High	+1.44
Academic writing and presentation of findings	2.66	Moderate	4.18	High	+1.52

Source: Delgado C.

The results show an improvement across all eight evaluation criteria after the implementation of Research-Based Learning. The overall mean increased from 2.67, representing a moderate level, to 4.09, representing a high level of research competence. The greatest improvement was observed in academic writing and presentation of findings, with an increase of 1.52 points. Data analysis and interpretation also showed an important improvement, increasing from 2.45 to 3.89. Overall, the findings indicate that the students developed stronger research-related competencies after participating in Research-Based Learning activities.

Discussion

The findings of this study indicate that Research-Based Learning had a positive effect on university students' research skills. The overall mean increased from a moderate level in the pre-test to a high level in the post-test, showing improvement across all eight evaluated criteria. These results suggest that engaging students directly in research-related activities can strengthen their ability to understand and apply the different stages of the research process.

The improvement observed in areas such as the identification of research problems, formulation of research questions and objectives, literature search, methodology selection, data collection, data analysis, and academic writing is consistent with previous studies that emphasize the value of active participation in research. Thiem et al. (2023) found that research-based learning contributed to improvements in students' self-reported research competencies, particularly in reviewing literature, understanding methodology, interpreting findings, and communicating results. Similarly, Wessels et al. (2021) reported positive changes in research-related competencies among university students participating in research-based learning courses.

One of the most relevant findings was the improvement in academic writing and the presentation of research findings. This result may be explained by the continuous opportunities students had to organize ideas, use academic sources, interpret evidence, and communicate research results during the intervention. These activities encouraged students to move beyond theoretical knowledge and apply research concepts in practical academic tasks. Vieno et al. (2022) argue that research competence includes not only methodological knowledge but also communication, critical appraisal, information synthesis, and data interpretation, which supports the multidimensional nature of the improvement found in this study.

The results also showed substantial progress in data analysis and interpretation, one of the areas in which students initially demonstrated lower performance. This suggests that repeated practice and guided research activities can help students develop confidence and competence in tasks that are often considered difficult in research methodology courses. Uaciquete and Valcke (2022) similarly found that active research-based experiences contributed to stronger research competence compared with more passive research-led approaches.

Overall, the findings support the use of Research-Based Learning as an effective instructional approach in university research subjects. By involving students directly in the research process, the strategy appears to promote a more practical understanding of methodological concepts and strengthen the skills necessary to conduct and communicate research. However, the results should be interpreted within the context of the specific group and course in which the intervention was implemented. Future studies could include larger samples, control groups, and longer intervention periods to determine whether these improvements are maintained over time and across different academic disciplines.

Conclusions

The implementation of Research-Based Learning produced a measurable improvement in university students' research competencies. The increase from a moderate pre-test level to a high post-test level across the eight evaluated criteria indicates that systematic engagement in research-oriented activities can strengthen students' ability to identify research problems, formulate questions and objectives, review academic literature, select methodological procedures, collect and analyze data, and communicate findings. These results support the effectiveness of Research-Based Learning as an instructional approach for developing research competence within university-level research courses.

The most pronounced improvements were identified in academic writing, presentation of findings, and data analysis and interpretation. These areas initially represented some of the students' weakest competencies but showed substantial progress after the intervention. This finding suggests that repeated exposure to authentic research tasks, accompanied by instructor guidance and continuous practice, can contribute to the development of higher-order academic skills that are difficult to consolidate through theoretical instruction alone.

The findings provide empirical support for the incorporation of Research-Based Learning into the teaching of research methodology and related university subjects. By positioning students as active participants in the research process, this approach facilitates the integration of theoretical knowledge with practical application and promotes a more comprehensive understanding of scientific inquiry. Nevertheless, the conclusions should be interpreted within the specific characteristics of the study context, and future research should examine the effectiveness of this approach with larger samples, comparison groups, and longitudinal designs in order to determine the consistency and sustainability of the observed effects.

Implications

The findings of this study have important pedagogical implications for the teaching of research-related subjects in higher education. The improvement observed across the evaluated research competencies suggests that Research-Based Learning can be incorporated as a systematic instructional strategy rather than being limited to isolated research assignments. University instructors may benefit from organizing research courses around progressive inquiry-based tasks in which students identify problems, formulate questions, review literature, select methods, analyze evidence, and communicate findings throughout the semester.

The results also imply that greater instructional attention should be given to competencies that commonly present difficulties for students, particularly data analysis, interpretation of findings, and academic writing. These areas may require repeated practice, structured feedback, and opportunities to apply methodological concepts in authentic research situations. Therefore, research courses should combine theoretical instruction with guided application in order to strengthen students' ability to transfer methodological knowledge into actual research performance.

At the institutional level, the study supports the integration of research-oriented learning experiences across undergraduate programs. Universities may consider strengthening curricular opportunities that allow students to participate actively in inquiry processes from the early stages of their academic preparation. Such integration could contribute to the development of stronger research competence, greater academic autonomy, and improved preparation for advanced academic work and evidence-based professional practice.

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