Development of investigative skills in Physical Culture students at the University of Guayaquil

Abstract

This research aimed to analyze the development of investigative skills in university students studying Physical Culture through an educational intervention. The sample was made up of 250 fifth semester students, distributed in the periods 2023-2024 and 2024-2025. Five key areas were evaluated: identification of research problems, formulation of hypotheses, search and analysis of information, writing of scientific reports and use of technological tools. The quasi-experimental design included the application of pretest and posttest. The results showed significant improvements: in the use of technological tools, the average performance went from 49.6 in the pretest to 50.0 in the posttest for 2023-2024, and from 49.8 to 50.0 for 2024-2025, with a correlation coefficient of 0.996 . In problem identification, the number of students in the "High" category increased from 75 to 90 in 2023-2024 and from 77 to 92 in 2024-2025. The standard deviation increased slightly, reflecting greater variability in the posttest. Despite these improvements, challenges remain, especially among students who remained in the "Very Low" or "Low" categories. It is concluded that the theoretical model is effective in improving research skills, but it is necessary to adjust pedagogical strategies to serve students with different learning rates.

Keywords: *research skills, educational intervention, university students*

Introduction

In recent decades, the relevance of research competencies in the context of higher education has acquired significant importance on a global scale. University institutions, in their role as entities in charge of the holistic education of future professionals, have the obligation to produce new knowledge and train students capable of carrying out research that contributes to society (Salgado, G., and Aguilar, M., 2021).

The University of Guayaquil, one of the most relevant higher education entities in Ecuador, has established in recent years a series of strategies aimed at promoting the development of research skills in its students. These include the establishment of research centers, incorporation of research methodology subjects in academic curricula, and the promotion of research projects financed by the university institution (Cubas, K., Gutarra, N., & Mansilla, R. , 2024). These initiatives have had a favorable influence on the quality of research carried out by students, particularly in fields such as social sciences and health.

The Latin American environment, and particularly the Ecuadorian one, poses particular challenges for the evolution of a robust research culture. In numerous instances, university institutions are hampered by budgetary constraints that hinder the funding of research projects, access to contemporary literature, and participation in international research networks (De Giusti, 2023). The University of Guayaquil is not an exception.

Despite the initiatives undertaken by the institution to promote research among its students, the lack of resources persists as a significant obstacle to the development of high-level research skills that are so necessary and even more so in the field of physical culture. This circumstance is intensified due to the insufficient research culture in the nation, in which the majority of students do not experience significant contact with research until the final phases of their academic training. (de Moreno, M., Herrera, S., and Andrade, D., 2024)

The incorporation of Information and Communication Technologies (ICT) in the educational process has been recognized as an essential instrument to enhance the development of research skills. Within the University of Guayaquil, the availability of digital libraries, scientific databases and specialized software has made it easier for students to access high-quality resources for their studies (Bernate, J., and Fonseca, I., 2023). However, the use of these tools continues to be restricted, given that a large number of them lack the digital skills required to optimize the use of these resources. Additionally, instruction in the use of Information and Communication Technologies (ICTs) and research tools is not always incorporated.

effectively in the study plans, which restricts its influence on the development of research skills (Novas, 2022).

A crucial element in the evolution of investigative skills is pedagogical assistance. Educators play a fundamental role in guiding students throughout the entire research process, from problem identification to formulation and presentation of findings. At the aforementioned university, it has been found that students who receive greater support and guidance from their educators tend to cultivate more robust research skills and experience greater security in the execution of their research projects (Paredes, M., Ramírez, M. ., Cardenas, V., Palomino, A., and Alania, R., 2023).

In this context, the University of Guayaquil has begun the implementation of strategies based on project-based learning (PBL), providing students with the possibility of developing research projects that are applied to specific problems in their environment (Sánchez, E. , Ramos, M., Linde, T., and Sánchez, J., 2023). However, its implementation is still restricted and a deeper integration of this methodology in the various academic programs is required.

Despite the progress achieved, the promotion of research skills in this field continues to be a favorable field for making significant improvements. It is imperative that the institution persist in strengthening its research training programs, guaranteeing that all students, regardless of their academic discipline, have the possibility of cultivating research skills progressively throughout their academic training (Reyes, P ., Castiblanco, A., Ruiz, A., and Angarita, M., 2020). This becomes even more necessary for Physical Culture students whose future professional work is to improve or maintain health, avoid or prevent injuries, among other aspects that require research.

However, in numerous academic institutions, including the University of Guayaquil, the emphasis on research training tends to be located in the final phases of the curriculum, which restricts the progressive development of said competencies (Poveda, F., Guáqueta, C., López, C., and Martínez, É., 2023). This contrasts with the requirement to establish research activities from the first years of training, with the aim of facilitating that students become familiar with the procedures and tools required for effective research. The incorporation of these disciplines in the curricula of the University of Guayaquil represents a significant advance; However, its effectiveness depends on the implementation methodology and the degree of research training that the teachers in charge of teaching these subjects have.

The implementation of Information and Communication Technologies (ICT) constitutes an essential element to enhance the development of investigative skills. The availability of digital libraries, scientific databases and specialized software makes it possible to carry out more rigorous and exhaustive research (Bernate, J., and Fonseca, I., 2023). At the University of Guayaquil, the implementation of technologies has facilitated students' access to high-quality resources for their studies. However, restrictions on its application still persist due to the lack of digital skills in certain students.

Therefore, the objective of this research was to analyze the development of investigative skills in university students studying Physical Culture through an educational intervention.

Materials and methods

The study population includes 250 students in the fifth semester of the discipline of Physical Culture, at the University of Guayaquil during the academic periods 2023-2024 cycle II (CII) and 2024-2025 cycle I (CI). They constitute an essential group in the research training

process, given that they are at a stage of their higher education in which the disciplines linked to scientific and methodological research begin to acquire a greater role.

Consequently, collaboration with this population is strategic to understand how Physical Culture students, in an intermediate phase of their training, cultivate the research skills required for their academic and work performance.

The methodology adopted for this study is non-experimental and cross-sectional, given that the variables are not manipulated nor controlled interventions will be carried out. Instead, data related to the students' research skills are collected in their natural environment, without affecting their learning or training process. The research will be carried out at a single moment for each of the academic periods, thus facilitating obtaining an "image" of the current situation of the students during the 2023-2024 CII cycle and the 2024-2025 CI cycle.

The main instrument for data collection was a structured questionnaire. The evaluation instrument is made up of closed items on a five-point Likert scale, in which students evaluate various aspects linked to their perception of the development of their research skills. This format is appropriate for this type of research, since it facilitates the efficient acquisition of quantitative data, in addition to simplifying the subsequent statistical analysis (Jiménez, 2020). The components will focus on the evaluation of the detection of research problems, the formulation of hypotheses, the search and analysis of information, the use of technological tools, and the ability to write and present scientific reports.

The second stage of the procedure was carried out during the 2024-2025 CI cycle, adhering to the same data collection protocol as in the initial phase. The same implementation conditions were preserved in order to guarantee the consistency and comparability of the results between both study periods. Additionally, the anonymity and privacy of the data was ensured, in accordance with established research ethical regulations. All students involved in the research signed an informed consent, in which the purposes of the research, the voluntariness of their participation and the right to withdraw from the study at any time were explained to them without this having repercussions on their academic performance.

Results and discussion

After the completion of data collection, analysis was carried out using descriptive and correlation statistical methods. Initially, a descriptive analysis is carried out to outline the degree of evolution of investigative skills in the population under study. This analysis will incorporate the distribution of frequencies, means and standard deviations of the responses

to each of the components of the questionnaire, thus facilitating the acquisition of a precise and clear perspective of the students' perceptions regarding their research skills. (Maurandi, A., and González, A., 2022)

Table 1. Identification of research problems.

	Students 2023-2024		**Students 2024-2025**	
Assessment	**Pretest frequency**	**Posttest Frequency**	**Pretest frequency**	**Posttest Frequency**
Very low	15	10	14	12

low	30	25	25	20
Medium	60	70	62	68
High	75	90	77	92
Very high	50	55	52	58

Group	**Type**	**Mean**	**Standard deviation**	**Coefficient of Correlation**
2023-2024	Pretest	46.0	23.82	0.9981
2023-2024	Posttest	50.0	32.60	0.9981
2024-2025	Pretest	46.0	26.07	0.9966
2024-2025	Posttest	50.0	33.53	0.9966

In the period 2023-2024, a significant increase is observed in the "High" category, where the frequency goes from 75 in the pretest to 90 in the posttest. This improvement suggests that, after the educational intervention, a greater number of students managed to improve their ability to identify research problems. Similarly, in the “Very High” category, there was also an increase from 50 to 55 students, reinforcing the idea of an advancement in investigative skills. The categories "Very low" and "Low" show a decrease in frequencies (from 15 to 10 and from 30 to 25 respectively), which suggests that fewer students perceive they have difficulties in this competence after the intervention.

In terms of descriptive statistics, the mean in the pretest was 46.0, increasing to 50.0 in the posttest. The standard deviation also increased, from 23.82 to 32.60, indicating greater dispersion in scores after the intervention. The correlation coefficient (0.9981) shows a strong relationship between the pretest and posttest results, suggesting that those students who initially had better results continued to improve in the same direction.

In the period 2024-2025, the results show a similar trend. In the "High" category, the frequency increased from 77 to 92, while in the "Very High" category there was also an increase from 52 to 58 students, indicating that more students achieved the highest levels of proficiency after educational intervention. The “Very Low” and “Low” categories also decreased slightly (from 14 to 12 and from 25 to 20, respectively), suggesting that fewer students faced difficulties after the intervention. Regarding descriptive statistics, the mean in the pretest was 46.0 and in the posttest it increased to 50.0, while the standard deviation went from 26.07 to 33.53, which indicates greater variability in the responses. The

correlation coefficient of 0.9966 indicates a strong relationship between the pretest and posttest results, confirming that students with better initial performance continued to improve.

The data reflect a general improvement in research problem identification skills in both academic periods. The theoretical model for the development of investigative skills appears to have been effective, as a greater number of students managed to achieve higher levels of competence, and the lowest performance categories decreased in size. The high correlation coefficients show that progress was consistent among students with different levels of initial ability.

Table 2. Distribution of responses with pretest and posttest in the Hypothesis formulation.

Assessment	**Students 2023-2024**		**Students 2024-2025**	
	Pretest Frequenc y	**Posttest Frequenc y**	**Pretest Frequenc y**	**Posttest Frequenc y**

Very low	25	20	22	18
low	40	35	38	30
Medium	70	75	68	70
High	75	80	80	85
Very high	30	40	35	47

Group	**Type**	**Mean**	**Standard deviation**	**Coefficient of Correlation**
2023-2024	Pretest	48.0	23.08	0.971
2023-2024	Posttest	50.0	26.22	0.971
2024-2025	Pretest	48.6	24.33	0.963
2024-2025	Posttest	50.0	27.65	0.963

In the period 2023-2024, a reduction is observed in the frequency of students who were in the lowest performance categories. In the "Very low" category, the frequency went from 25 in the pretest to 20 in the posttest, while in the "Low" category, the frequency decreased from 40 to 35. This suggests that the students who had greater difficulties in the formulation of hypotheses managed to advance. At the same time, the "Medium", "High" and "Very High" categories showed an increase in the number of students, especially in the "Very High" category, where the frequency increased from 30 to 40 students.

These improvements are reflected in the mean, which went from 48.0 in the pretest to 50.0 in the posttest, and in the standard deviation, which also increased from 23.08 to 26.22, indicating greater dispersion in the scores after the intervention. The correlation coefficient of 0.971 reflects a high relationship between pretest and posttest scores, suggesting that students who initially showed better performance continued to improve consistently.

In the period 2024-2025, similar results are presented. The "Very Low" category decreased from 22 in the pretest to 18 in the posttest, while the "Low" category also reduced its frequency from 38 to 30 students. In contrast, the "Very High" category showed a significant increase, going from 35 to 47 students, which shows notable progress in students who reached a high level in the formulation of hypotheses. The mean in this period also increased from 48.6 in the pretest to 50.0 in the posttest, with a standard deviation that went from 24.33 to 27.65, which, as in the previous period, reflects a greater dispersion in the scores after the

intervention. . The correlation coefficient of 0.963 indicates a strong relationship between pretest and posttest scores, suggesting that students with better initial scores continued to show steady improvement.

Both periods reflect a general trend of improvement in the ability to formulate hypotheses after the educational intervention. The decrease in the low performance categories and the increase in the higher competence categories show that the theoretical model for the development of investigative skills appears to have been effective in helping students advance. The high correlation coefficients in both periods reinforce the idea that students improved consistently and progressively.

Table 3 Distribution of responses with pretest and posttest in the search and analysis of information.

Assessment	**Students 2023-2024**	**Students 2024-2025**

	Pretest Frequency	Posttest Frequency	Pretest Frequency	Posttest Frequency
Very low	10	5	9	7
low	25	20	22	18
Medium	55	50	60	55
High	90	100	88	98
Very High	70	75	68	72

Group	Type	Mean	Standard deviation	Coefficient of Correlation
2023-2024	Pretest	50.0	32.60	0.996
2023-2024	Posttest	50.0	38.89	0.996
2024-2025	Pretest	51.8	36.65	0.996
2024-2025	Posttest	50.0	37.70	0.996

In the period 2023-2024, a clear decrease is observed in the frequency of students in the lowest categories. For example, in the "Very Low" category, the frequency decreased from 10 students in the pretest to 5 in the posttest, and in the "Low" category, the frequency decreased from 25 to 20 students. This pattern indicates that students who initially had difficulties in searching and analyzing information managed to make progress after the intervention. The "Medium", "High", and "Very High" categories reflect increases in the posttest, with a significant increase in the "High" category, which went from 90 to 100 students, suggesting that a large number of students achieved a higher level of proficiency in this skill.

Regarding descriptive statistics, the mean remained stable at 50.0 in both the pretest and posttest, while the standard deviation increased from 32.60 to 38.89, suggesting greater variability in the results after the intervention. The correlation coefficient of 0.996 shows a strong

relationship between pretest and posttest scores, indicating that those students who initially performed better continued to show consistent improvements.

In the period 2024-2025, a similar pattern is reflected. The frequency of students in the “Very Low” category decreased from 9 in the pretest to 7 in the posttest, and in the “Low” category, the frequency decreased from 22 to 18 students. The "High" and "Very High" categories show increases in the post-test, with a particularly significant increase in the "High" category, which went from 88 to 98 students. These results reflect significant progress in the students' skill level.

The mean in this period went from 51.8 in the pretest to 50.0 in the posttest, which indicates a slight reduction in the average, although this could be related to the greater dispersion observed in the posttest scores, as suggested by the standard deviation. which went from 36.65 in the pretest to 37.70 in the posttest. As in the previous period, the correlation coefficient of 0.996 reflects a strong relationship between the pretest and posttest scores, indicating that students with better initial results continued to improve consistently.

The results show a general improvement in information search and analysis skills after the application of the theoretical model for the development of investigative skills in both periods. The reduction in the low-performing categories and the increase in the higher categories suggest that students advanced in their ability to handle information more effectively. The high correlation coefficients in both periods reinforce the consistency in the students' progress.

Table 4. Distribution of responses with pretest and posttest in the writing of scientific reports.

Assessment	**Students 2023-2024**		**Students 2024-2025**	
	Pretest Frequency	**Posttest Frequency**	**Pretest Frequency**	**Posttest Frequency**
Very low	18	15	16	14
low	35	30	32	28
Medium	60	65	62	68
High	75	85	80	88

Very High	50	55	48	52

Group	**Type**	**Mean**	**Standard deviation**	**Coefficient of Correlation**
2023-2024	Pretest	47.6	22.05	0.9957
2023-2024	Posttest	50.0	27.84	0.9957
2024-2025	Pretest	47.6	25.00	0.9975
2024-2025	Posttest	50.0	29.80	0.9975

In the period 2023-2024, a decrease is observed in the number of students in the lowest performance categories. In the "Very low" category, the frequency went from 18 in the pretest to 15 in the posttest, while in the "Low" category, the frequency was reduced from 35 to 30 students. This change suggests that some of the students with difficulties in writing scientific reports managed to improve. On the other hand, in the "Medium", "High", and "Very High" categories, increases are observed in the number of students who reached these performance levels in the post-test, the most notable being the increase from 75 to 85 students. in the "High" category.

The average also reflects this progress, going from 47.6 in the pretest to 50.0 in the posttest. However, the standard deviation increased from 22.05 to 27.84, suggesting that there was greater dispersion in the results after the intervention. The correlation coefficient of 0.9957 shows a very strong relationship between pretest and posttest scores, indicating that students who initially had better scores continued to improve, while those who started with lower scores also showed progress.

In the period 2024-2025, the results reflect a similar pattern. The frequency of students in the "Very Low" category decreased from 16 to 14, while a decrease from 32 to 28 students was also observed in the "Low" category. On the other hand, the number of students in the "High" category increased from 80 in the pretest to 88 in the posttest, and the "Very High" category showed a slight improvement, going from 48 to 52 students. These results indicate that more students managed to achieve a higher level of competence in writing scientific reports after the intervention.

The mean in this period went from 47.6 in the pretest to 50.0 in the posttest, and the standard deviation increased from 25.00 to 29.80, which suggests greater dispersion in the results. The correlation coefficient of 0.9975 shows a very strong relationship between the pretest and posttest scores, indicating that students with better initial scores continued to improve consistently.

The results show a general improvement in scientific report writing skills in both periods. The reduction in the low performance categories and the increase in the higher categories suggest that the theoretical model for the development of investigative skills was effective in improving students' skills. The coefficients of

High correlations reinforce the idea that students made constant and progressive progress after the intervention.

Table 5. Distribution of responses with pretest and posttest in the use of technological tools.

Assessment	**Students 2023-2024**		**Students 2024-2025**	
	Pretest Frequency	**Posttest Frequency**	**Pretest Frequency**	**Posttest Frequency**
Very low	15	12	14	10
low	28	22	25	20
Medium	55	60	58	65
High	80	85	83	83
Very High	70	71	69	72

Group	**Type**	**Mean**	**Standard deviation**	**Coefficient of Correlation**
2023-2024	Pretest	49.6	27.54	0.996
2023-2024	Posttest	50.0	31.60	0.996
2024-2025	Pretest	49.8	29.30	0.993

2024-2025	Posttest	50.0	32.78	0.993

In the period 2023-2024, a decrease is observed in the frequencies of the lowest performance categories. For example, in the "Very Low" category, the frequency decreased from 15 in the pretest to 12 in the posttest, while in the "Low" category, it decreased from 28 to 22 students. These data indicate an improvement in students' abilities to use technological tools. In higher categories, such as "High" and "Very High", increases were also observed. In the "High" category, the frequency went from 80 in the pretest to 85 in the posttest, and in "Very High", it increased from 70 to 71 students.

The mean for this group showed a slight increase, going from 49.6 in the pretest to 50.0 in the posttest. However, the standard deviation increased from 27.54 to 31.60, indicating greater dispersion in the posttest scores. The correlation coefficient of 0.996 reflects a high correlation between the pretest and posttest, suggesting a consistent improvement in the use of technological tools after the intervention.

In the period 2024-2025, similar results are observed. The "Very Low" and "Low" categories experienced a reduction in the number of students, going from 14 to 10 and from 25 to 20 respectively. In the highest categories, such as "High", the frequency remained constant at 83 students in the pretest and posttest, while the "Very High" category increased from 69 to 72 students. These results indicate that students have improved their ability to use technological tools after the intervention.

The mean also showed a slight increase, going from 49.8 in the pretest to 50.0 in the posttest, while the standard deviation increased from 29.30 to 32.78, which also indicates greater variability in the posttest results. The correlation coefficient of 0.993 continues to show a strong relationship between the pretest and the posttest, which reinforces the trend of continuous improvement in this skill.

The results of both periods indicate an advance in students' skills in the use of technological tools. The decrease in the lowest performance categories and the increase in the highest categories suggest that the theoretical model for the development of investigative skills was effective in improving these skills. High correlation coefficients reinforce consistency in student progress, demonstrating that those who started with better skills continued to improve and those with difficulties also managed to advance.

The derived findings indicate significant progress in each of the areas after the educational intervention, with notable improvements in the students' research skills during the 2023-2024 and 2024-2025 academic periods respectively. These improvements are not only manifested in the reduction of lower performance categories, but also in the increase of students who have achieved higher levels of performance.

Regarding the detection of investigative problems, a significant improvement was recorded in both cohorts analyzed. Prior to the intervention, a significant percentage of students were classified in the “Very Low” and “Low” categories, evidencing the challenges in identifying relevant and clearly defined research problems. After the intervention, a notable decrease was observed in these categories, which suggests that the students achieved greater ability to formulate coherent research problems aligned with current academic and scientific reality. This finding aligns with previous research that postulates that direct guidance and specialized training in problem identification skills contribute significantly to the development of investigative skills (Díaz, A., Contreras, D., and Hernández, S., 2024).

Furthermore, the findings in the elaboration of hypotheses show a positive trend. This is manifested in the decrease in the lower performing categories and the increase in the "High" and "Very High" categories. This progress may be associated with the pedagogical methodology implemented, which places emphasis on understanding the epistemological principles of research and logical precision in the formulation of hypotheses. Contemporary research (Reyes, P., Castiblanco, A., Ruiz, A., and Angarita, M., 2020) has shown that an approach oriented towards deductive and inductive reasoning enhances students' ability to formulate robust hypotheses, a crucial element for success in the field of scientific research.

Regarding data inquiry and analysis, the findings show notable progress in both cohorts. Students who were at lower levels in their first levels of competence managed to advance to intermediate and advanced levels. This advancement is essential, given that the ability to locate and examine information constitutes an essential competency in the research process. The observed optimization can be attributed to the establishment of pedagogical strategies that encourage the critical and effective use of academic databases and digital tools. This aligns with previous research that emphasizes the relevance of information literacy in promoting investigative skills in the university context (Cubas, K., Gutarra, N., and Mansilla, R., 2024).

In relation to the preparation of scientific reports, the findings show a significant increase in students' skills. After the intervention, a significant increase was observed in the number of students in the "High" and "Very High" categories, which suggests that they managed to optimize

fundamental elements such as the structure, the use of bibliographic references and the methodological rigor in their studies. information. The ability to prepare a solidly based scientific report is an essential competence

for any academic, as it ensures adequate dissemination and accurate transmission of research findings. Optimization in this field can be associated with the establishment of scientific writing workshops, which have proven to be effective in the development of writing skills in university students (Javier, C., del Carmen, V., and Alejandro, M. , 2023).

The use of technological instruments represents another facet in which students showed significant progress. Prior to the intervention, a significant proportion of students had difficulties effectively using the technological tools required for research, such as statistical analysis software or bibliographic reference management applications. After the intervention, a decrease was recorded in the lower performance categories and an increase in the higher categories, which shows increased competence in the use of these tools. These findings correspond to research that highlights the relevance of the domain of technologies in contemporary research, particularly in a scenario of growing digitalization and globalization of knowledge (Bernate, J., & Fonseca, I., 2023).

The correlation coefficients computed for each field show a significantly high correlation between the pretest and posttest scores in both analyzed cohorts. This suggests that students who showed superior performance in various disciplines persisted in their improvements after the intervention, which suggests that the educational program implemented was effective not only for students with difficulties, but also for those with high initial performance. This finding aligns with existing literature that postulates that appropriately structured interventions can provide benefits to both students facing challenges and those with optimal academic performance (Fiallos, 2021).

There was an increase in the variability of the results after the intervention. This could suggest that, although the majority of students showed progress, the magnitude of said progress varied between different individuals. This phenomenon is common in educational interventions, given that students tend to evolve at varying rates depending on their previous skills, learning styles and motivation levels (De Giusti, 2023). Consequently, it would be beneficial to investigate in future studies the factors that affect the variability of the results and how they can be addressed to ensure more homogeneous progress among students.

The findings of this research emphasize the relevance of pedagogical interventions aimed at promoting research skills in the field of higher education. Optimization in fundamental areas such as problem identification, hypothesis formulation, information search and analysis, and scientific reporting shows that students can cultivate these competencies with appropriate support.

Although the findings indicate advances in investigative skills, it would be beneficial to carry out long-term monitoring to evaluate whether these improvements persist over time and how they are manifested in the professional practice of students once they join. to the labor market or graduate programs. Subsequent research should address these constraints with the goal of offering a more holistic understanding of the long-term effect of the theoretical model on investigative skills.

Conclusions

The effectiveness of the theoretical model aimed at the development of research skills in higher education students is confirmed. The results reflect significant improvements in key areas such as the identification of research problems, the formulation of hypotheses, the search and analysis of information, the writing of scientific reports and the use of technological tools.

The applied pedagogical intervention allowed students, both those with initial difficulties and those with better performance, to progress in their skills. This progress is particularly significant in the high performance categories, where there is an increase in the frequencies of the post-test compared to the pre-test, which shows that the intervention was effective in strengthening investigative skills at various levels of competence. The high correlation coefficients between the pretest and posttest scores highlight a positive relationship between the educational intervention and the increase in student performance, both in the short and medium term.

Greater heterogeneity was evident in the posttest results, which suggests that the academic progress of all students was not homogeneous. Although the majority showed improvements, there is a small group that did not achieve significant progress, remaining in the "Very low" or "Low" categories. This circumstance underscores the need to implement more individualized pedagogical strategies that adjust to the particular needs of students with the greatest challenges.

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