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Active pedagogical strategies: a project-based approach for teaching statistics in higher education

Estratégias pedagógicas ativas: uma abordagem baseada em projetos para o ensino de estatística no ensino superior

Estrategias pedagógicas activas: un enfoque basado en proyectos para la enseñanza de la estadística en la educación superior

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ABSTRACT

Introduction: This study aimed to evaluate the effectiveness of the research project method as a pedagogical strategy for teaching descriptive statistics to students at the Faculty of Education and Humanities, a public university in Peru. The research focused on comparing the learning outcomes of an experimental group using this method with a control group employing traditional teaching methods. **Methods**: A quasi-experimental design was used, involving pre- and post-tests to assess the learning levels of students in various dimensions of descriptive statistics, including collection, tabulation, processing, presentation, and analysis. The sample consisted of second-cycle students from the faculty, divided into experimental and control groups. **Results**: The results revealed significant improvements in the experimental group, with 67% of students achieving an excellent learning level, compared to 73% of the control group reaching only a regular level. A t-value of 17.09 confirmed the statistical significance of the difference in performance. The experimental group demonstrated enhanced proficiency in data collection, processing, presentation, and analysis, particularly in the presentation dimension, where scores increased from 1.87 to 3.68 points. **Conclusion**: The findings indicate that the research project method significantly enhances the learning of descriptive statistics, fostering critical analytical skills essential for academic and professional success. The study suggests the method's potential for broader application across disciplines and educational contexts, recommending further research on its long-term effectiveness and its impact on student motivation and self-efficacy.

Keywords: Statistics education, innovative pedagogy, active learning, pedagogical strategy, analytical skills, educational innovation.

RESUMO

Introdução: Este estudo avaliou a eficácia do método de projeto de pesquisa como estratégia pedagógica para o ensino de estatística descritiva para alunos da Faculdade de Educação e Ciências Humanas de uma universidade pública do Peru, comparando os resultados de aprendizagem de um grupo experimental e de um grupo de controle. Métodos: Foi utilizado um projeto quase experimental, com pré e pós-testes para avaliar os níveis de aprendizado em dimensões como coleta, tabulação, processamento, apresentação e análise. Os participantes eram alunos do segundo ciclo da faculdade. Resultados: Os resultados mostraram melhorias significativas no grupo experimental, com 67% alcançando um nível excelente, em comparação com 73% do grupo de controle que alcançou apenas um nível regular. Um valor t de 17,09 validou a diferença estatisticamente significativa no desempenho. O grupo experimental mostrou maior proficiência em todas as dimensões, principalmente na apresentação, em que as pontuações aumentaram de 1,87 para 3,68 pontos. Conclusão: Os resultados indicam que o método do projeto de pesquisa melhora significativamente o aprendizado da estatística descritiva, promovendo habilidades analíticas essenciais para o sucesso acadêmico e profissional. Recomenda-se sua implementação em várias áreas educacionais e mais pesquisas sobre sua eficácia a longo prazo.

Palavras-chave: Educação estatística, pedagogia inovadora, aprendizado ativo, estratégia pedagógica, habilidades analíticas, inovação educacional.

RESUMEN

Introducción: Este estudio evaluó la eficacia del método de proyecto de investigación como estrategia pedagógica para enseñar estadísticas descriptivas a los estudiantes de la Facultad de Educación y Humanidades de una universidad pública en Perú, comparando los resultados de aprendizaje de un grupo experimental y uno de control. **Métodos**: Se utilizó un diseño cuasi-experimental, con pruebas pre y post para evaluar los niveles de aprendizaje en dimensiones como recolección, tabulación, procesamiento, presentación y análisis. Los participantes fueron estudiantes del segundo ciclo de la facultad. **Resultados**: Los resultados mostraron mejoras significativas en el grupo experimental, con un 67% alcanzando un nivel excelente, frente al 73% del grupo control que solo logró un nivel regular. Un valor t de 17,09 validó la diferencia estadísticamente significativa en el rendimiento. El grupo experimental mostró mayor competencia en todas las dimensiones, destacándose en la presentación, donde las puntuaciones aumentaron de 1,87 a 3,68 puntos. **Conclusión**: Los hallazgos indican que el método de proyecto de investigación mejora significativamente el aprendizaje de las estadísticas descriptivas, promoviendo habilidades analíticas esenciales para el éxito académico y profesional. Se recomienda su implementación en diversas áreas educativas y más investigaciones sobre su efectividad a largo plazo.

Palabras clave: Enseñanza de la estadística, pedagogía innovadora, aprendizaje activo, estrategia pedagógica, capacidad de análisis, innovación educativa.

INTRODUCTION

In our era, called the "information society", individuals are required not only to handle voluminous amounts of data, but also to apply this knowledge in the creative solution of diverse problems, including social, scientific, economic and ideological ones: creativity becomes a crucial skill on a daily basis when facing these challenges. Education plays a fundamental role in the transmission of knowledge accumulated throughout social development, standing out for its undeniable social influence, given that it seeks, through teaching, not only to impart knowledge but also to continuously perfect educational methods to ensure comprehensive training (Jakab, Kittl, & Kieslich, 2024).

Currently, there is a trend towards modernization of the classroom through the integration of various didactic resources that link education with real life, as this not only solves the contradiction between the growing volume of information and limited time for teaching, but also encourages constant updating of teachers' pedagogical skills through appropriate training programs (Auhunas, 2024; Barbosa-Quintero & Estupiñán-Ortiz, 2023).

In Peru, several educational institutions offer the subject of Statistics within their education programs; it is notable that, both in undergraduate and graduate programs, statistics is recognized as a crucial tool for the development of research skills; despite its importance, high failure rates are reported in subjects related to mathematics and statistics, indicating a need to re-evaluate and improve the teaching methods used.

In response to this problem, the research project method is proposed as an innovative strategy for teaching descriptive statistics; this approach not only allows students to be actively involved in their learning through the development of projects that start from the problem statement to the formulation of hypotheses, but also aligns with the needs of interactive learning, self-managed and adaptable to constant changes in the professional and academic environment.

This research focuses on the teaching-learning process of descriptive statistics in students of a public sector university, specifically analyzing the effectiveness of the research project method in improving this process.

The empirical observation of the teaching process of descriptive statistics in a public university has revealed a significant disconnection between the content taught and its application in real life contexts; this gap is manifested in the difficulty of students to integrate theoretical knowledge of statistics with practical situations in their professional and everyday environment; This gap not only limits the understanding and appreciation of the role that descriptive statistics plays in society and in scientific research, but also has a negative impact on the development of essential analytical skills, resulting in low levels of academic performance and insufficient preparation to face the challenges of the work and academic environment.

The research addressed a crucial aspect in the teaching of descriptive statistics in a public university; the study was justified by the need to prepare future educators to face and solve socio-educational problems relevant to the society of Sint Maarten, through a deep understanding of statistics as a tool for analysis and decision making. In addition, the research proposed to enrich the educational theoretical corpus in technological institutes and universities through the incorporation of the research project method, offering a new dynamic in the approach to educational objects of study.

The general objective of the research was to develop the research project method as a strategy to improve the learning of descriptive statistics among students at a public university. The specific objectives included defining scientific research problems in a logical and coherent manner, identifying relationships between variables within an educational context. It was also proposed to clearly articulate the objectives of each scientific research project developed by the students, to formulate clear research hypotheses involving the study variables, and to evaluate the learning levels of descriptive statistics in terms of data collection, tabulation, processing, presentation and analysis, through post-intervention tests in experimental and control groups.

The hypothesis posed suggested that the implementation of the research project method as a pedagogical strategy would result in a significant improvement in the learning of descriptive statistics among students at a public university.

Literature review

Yusra and Najwa (2024) focused on determining factors that influence the retention of newly acquired skills, such as intrinsic motivation and interest, and explores the relationship between knowledge retention and its practical application, within the context of Jordan's Vision 2030 educational goals. Gul and Karacay (2024) identified variables influencing nursing students' self-efficacy in an online education environment, such as demographic characteristics, technology use, and perceptions of the advantages of online learning, during the 2020-2021 academic year in Turkey.

Jarrah et al. (2024) employed quantitative methods such as descriptive statistics, correlation analysis, and multiple regression analysis to examine the relationship between gamification, narrative elements, and the acquisition of new skills. Banerjee et al. (2024) results, confirmed by Diebold-Mariano tests and alternative data partitioning methods, demonstrate

that commodity markets are susceptible to fake news and media hype. Moreover, Sindermann et al. (2021) revealed the existence of absolutely homogeneous political information environments and outline who might be more inclined to a more homogeneous versus more heterogeneous information environment.

Barrientos et al. (2024) indicated that DP methods are feasible for simple univariate statistics, but have difficulties in producing accurate regression estimates and confidence intervals. This study represents, according to the authors, the first comprehensive statistical analysis of the DP regression methodology on real and complex data sets, with significant implications for the direction of a growing field of research and public policy.

Statistics, recognized as an essential science, is dedicated to the collection, organization, analysis, and interpretation of quantitative data to deduce precise meanings or make future predictions (Sanulita et al., 2024). This field encompasses a broad spectrum of activities ranging from data tabulation to data presentation and detailed analysis, facilitating effective decision making in various fields (Hakimi, Shahidzay, Fazi, & Qarizada, 2024).

Several authors have contributed definitions that reflect the breadth and depth of statistics. According to Wahyuda et al. (2022) defined it as the science that quantitatively studies collectives. Other definitions point to statistics as the quantitative expression of knowledge, structured for critical analysis (Regar & Repi, 2023; Afni et al., 2024). The definition most recognized by the academic community is that of Mínguez, where Safa and Wicaksono (2022) describe statistics as "the science that applies the laws of quantity to social facts to measure their intensity, deduce the laws that govern them and make predictions about them". This perspective underlines the relevance of statistics in the understanding and projection of social phenomena. It is essential to clarify the common confusion among students about the terms associated with statistics (Fu et al., 2022).

Descriptive statistics, one of the fundamental components of this science, focuses on organizing and summarizing numerical data. This branch of statistics is essential for presenting data graphically or illustratively and for calculating descriptive measures that facilitate the interpretation of large volumes of data Salas, 2022). The learning process of descriptive statistics focuses on essential skills such as the design and construction of statistical tables and graphs, in addition to the calculation and interpretation of measures of central tendency such as the arithmetic mean, median and mode (Huei-Fu, 2023).

The subject of General Statistics is pivotal, intervening in all phases of research work from the selection of variables to the interpretation of the results, ranging from purely statistical aspects, such as study design and sampling, to others more dependent on the context of the problem under investigation, such as the selection of units of analysis and variables (Huei-Fu, 2023). The main objective of teaching this discipline is that students, through the development of research projects, not only acquire the fundamentals of statistics within the educational sciences, but also understand its usefulness as an integral analytical tool in research methodology Acosta & Brooks, 2021).

The teaching of descriptive statistics trains students to reflexively use statistical tools in the association of variables and in the treatment of data obtained from the observation of real phenomena. Through the scientific method, students become familiar with the variables of their educational environment and develop skills for the systematization of content, the accurate identification of educational variables, and the appropriate classification of information according to their scales of measurement (Acosta & Brooks, 2021). This pedagogical approach, has fostered in students the ability to communicate, the handling of scientific information and the development of critical and flexible thinking, all indispensable elements for an educated professional who, aware of the lack of absolute certainties, must be prepared to adapt and respond to the demands of a constantly changing environment (Rizvi & Nabi, 2021).

Historically, learning was considered synonymous with behavioral change, dominated by a behaviorist perspective in education. However, it is widely recognized that human learning transcends a simple change in behavior, profoundly affecting the meaning of lived experience, given that human experience involves not only thought but also affectivity, and it is the combination of both aspects that truly enriches the learner's learning (Chamisijatin et al., 2023).

Understanding education requires considering multiple elements of the educational process: teachers' teaching methods, the structure of the curriculum, and the social context in which learning takes place. Educational psychology plays a fundamental role in this process, providing a theoretical basis that allows educators to optimize their teaching methods beyond the inefficient "trial and error" approach (Chamisijatin et al., 2023). In the teaching of statistics, this approach has profound implications. It allows educators to build on the student's existing knowledge base, facilitating more integrated and enduring learning; statistical concepts can be introduced in ways that relate directly to previous cognitive structures, which not only enhances understanding of new concepts, but also reinforces and expands understanding of knowledge already possessed (Darmayanti et al., 2023).

The theory of discovery learning, developed in the 1960s and 1970s by Bruner, has been fundamental in the transformation of educational practices, particularly in the sciences. This pedagogy, driven by the need to break with

traditional approaches based on the memorization of content, promotes active learning where students interact directly with the subject matter, facilitating a deep and applied understanding of scientific content. Jerome Bruner, one of the main proponents of this theory, argues that discovery learning not only revitalizes educational content, but also aligns teaching methods with real scientific processes, fostering a positive attitude towards continuous learning and research (Svinick, 1998).

The discovery learning process unfolds in three fundamental stages, known as the enactive, iconic and symbolic modes. These stages represent different ways in which students can interact with the material, from direct physical actions on concrete objects, to visual representations (iconic), and finally, the use of abstract symbols such as language and numbers (symbolic). Each stage builds on the previous one, allowing students to develop a comprehensive understanding of the content (Alenezi, 2023). This approach has significant implications for the teaching of statistics, where students can benefit greatly from methods that allow them to actively explore and discover statistical principles for themselves, rather than simply learning formulas and techniques passively. By applying discovery learning theory in teaching statistics, educators can help students develop a deeper understanding of statistical concepts and apply this knowledge effectively in a variety of scientific and everyday situations Gupta & Yadav, 2023).

The research project method is defined as a comprehensive pedagogical strategy that fosters the development of scientific skills and attitudes through a sequence of activities focused on problem solving. This methodology, described by Fumagalli in 1993, is especially relevant in the teaching of experimental sciences such as descriptive statistics, where it seeks not only to transmit knowledge, but also to cultivate a robust mental infrastructure that prepares students for independent research and continuous learning (Esteve-Mon et al., 2022). The theories of the Historical-Cultural Approach, Activity Theory and Contemporary Didactics deeply underpin the use of the research project method in the teaching of Descriptive Statistics. Nina F. Talizina, influenced by the Russian psychological school and activity theory, argues the importance of restructuring the subjects to focus on a common base that allows students to build more specific knowledge (Imran et al., 2023). The application of the activity theory in education allows seeing the student's action as central in the teaching process, where each action is part of a broader cognitive process that includes the transformation and enrichment of previous knowledge and skills. This process of appropriation of knowledge must be externally modeled so that, through its gradual transformation, it is internalized and guarantees the formation of mental skills (Alenezi et al., 2023).

The implementation of the research project method in the teaching of Descriptive Statistics according to these theories implies an approach that values joint activity and cooperation, both among students and between them and the teacher. This approach transforms the traditional relationship of authority in the classroom and places the learning process at the center of the educational action, allowing students to play an active and conscious role in their own learning process. This facilitates not only the acquisition of statistical knowledge, but also the development of investigative and critical skills that are essential for their future professional and personal lives (Núñez-Canal et al., 2022). In this sense, Mario Bunge, in 1969, characterized the scientific method as the way to perform good science, applicable to both natural and social sciences, whether pure or applied. Sierra Bravo, referred to by Gálvez in 2003, sees the scientific method as the process of formulating questions about reality based on already existing observations and theories, anticipating solutions and verifying them with reality through the observation of facts (Wigginton & Abecasis, 2005).

Descriptive statistics, according to Hamdan et al. (2021) involves the collection, presentation, description, analysis and interpretation of data, essentially summarizing them with one or two elements of information that characterize the total set of data. Data, according to Avila Acosta (2003), are measures or values of characteristics that can be observed and counted, originating from the observation of variables in a group of elements or units. The population, as defined by Neil J. Salkind in 1999, is the largest set of values of a variable that is of interest to study. A sample, also according to Salkind, is a representative part of the population that allows generalizations to be made about it.

METHODS

A quasi-experimental methodological approach was adopted as described by Hernández, Fernández and Baptista (1991), who propose the "Design with test-post-test and intact groups (one of them as control)". This approach employs two intact groups where one group experiences the treatment and the other acts as a control group. Both groups are evaluated by means of a pretest to ensure their initial equivalence. Subsequently, a post-test is conducted to determine the effects of the experimental treatment on the dependent variable.

The research was focused on a population of undergraduate students, totaling approximately 180 students. The selected sample included students of the second cycle of the general statistics course of the Elementary Education Professional Career, composed of 30 students in both the experimental and control groups. This selection was made for the convenience of the researcher, which were extracted from the register of the Academic Department of Education of the Faculty of Education and Humanities, Universidad Nacional de San Martín, Tarapoto (FEH-R/UNSM-T). The research process

involved the creation of a syllabus for the 16 weeks of academic work and the development of a measurement instrument comprising several items to evaluate different dimensions of learning. The students were subjected to a research project methodology as an educational strategy, applying both the pre-test and post-test to the groups involved.

For data collection, techniques and tools such as frequency tables, questionnaires and direct observation were used. The analysis of the documents helped to evaluate the academic performance and emerging data of the research. The statistical treatment of the information involved the formulation of statistical hypotheses to compare the means between the experimental and control groups, using Student's test. A confidence level of 95% and a statistical error of 5% were established. The results of the tests determined whether the experimental treatment, i.e., the research project method, had a significant impact on learning descriptive statistics. In addition, specific evaluation instruments were developed to measure the competencies acquired in descriptive statistics, classifying the learning levels from Deficient to Excellent, and breaking down the scores according to the evaluated dimensions such as collection, tabulation, processing, presentation and analysis for decision making. The methodology and tools employed provided a clear picture of how the implementation of the research project method as a pedagogical strategy can influence the educational process and students' academic performance in descriptive statistics.

RESULTS AND DISCUSSION

The following results present an analysis of the learning levels of descriptive statistics among students in the second cycle of the Faculty of Education and Humanities at a public university in Peru. The data is based on pre- and post-test evaluations for both control and experimental groups. Table 1 illustrates the overall learning levels of descriptive statistics, showing significant improvement in the experimental group post-test results, as indicated by the statistical test (t_c = 17.09, t_α = 1.674, ρ < 0.05). In terms of specific dimensions, Tables 2 through 6 highlight the learning progress across five key areas: "collection," "tabulation," "processing," "presentation," and "analysis for decision making." These results demonstrate a marked increase in performance in the experimental group across all dimensions, particularly in "presentation" and "analysis for decision making," where the experimental group showed substantial improvement. Finally, Table 7 presents a comparative analysis of the post-test averages between the control and experimental groups, revealing a notable overall improvement in the experimental group.

Table 1. Level of learning of descriptive statistics in students of the second cycle of FEH-R/UNSM-T.

Learning Level	Control Group				Experimental Group			
	Pre test		Post test		Pre test		Post test	
	N.	%	N.	%	N.	%	N.	%
Deficient [00-10[	30	100	-	-	30	100	-	-
Regular [10-13[	-	-	22	73	-	-	-	-
Good [13-16[	-	-	8	27	-	-	4	13
Very Good [16-18[	-	-	-	-	-	-	6	20
Excellent [18-20]	-	-	-	-	-	-	20	67
$\overline{X} \pm S$	2.20 ± 0.85		11.83 ± 1.21		3.03 ± 1.16		17.60 ± 1.40	
Statistical test	t_c = 17.09		t_α = 1.674		ρ < 0,05		Decides to reject H_0	

Note: Data obtained from the tests applied.

Table 2. Level of learning of descriptive statistics in students of the second cycle of the FEH-R/UNSM-T, according to the dimension "collection"

Learning Level	Control Group				Experimental Group			
	Pre test		Post test		Pre test		Post test	
	N.	%	N.	%	N.	%	N.	%
Deficient [0-2[	30	100	-	-	30	100	-	-
Regular [2-2.6[	-	-	18	60	-	-	5	17
Good [2.6-3.2[	-	-	7	23	-	-	6	20
Very Good [3,2-3,6[	-	-	5	17	-	-	3	10
Excellent [3,6-4]	-	-	-	-	-	-	16	53
$\overline{X} \pm S$	0.78 ± 0.43		2.54 ± 0.40		0.99 ± 0.52		3.28 ± 0.53	

Note: Data obtained from the tests applied.

Table 3. Level of learning of descriptive statistics in students of the second cycle of the FEH-R/UNSM-T, according to the dimension "tabulation"

Learning Level	Control Group				Experimental Group			
	Pre test		Post test		Pre test		Post test	
	N.	%	N.	%	N.	%	N.	%
Deficient [0-2[	30	100	5	17	30	100	-	-
Regular [2-2.6[	-	-	21	70	-	-	-	-
Good [2.6-3.2[	-	-	4	13	-	-	7	23
Very Good [3,2-3,6[	-	-	-	-	-	-	5	17
Excellent [3,6-4]	-	-	-	-	-	-	18	60
$\overline{X} \pm S$	0.58 ± 0.32		2.25 ± 0.50		0.63 ± 0.39		3.68 ± 0.43	

Note. Data obtained from the tests applied.

Table 4. Level of learning of descriptive statistics in students of the second cycle of the FEH-R/UNSM-T, according to the dimension "processing"

Learning Level	Control Group				Experimental Group			
	Pre test		Post test		Pre test		Post test	
	N.	%	N.	%	N.	%	N.	%
Deficient [0-2[	30	100	2	7	30	100	-	-
Regular [2-2.6[	-	-	21	70	-	-	1	3
Good [2.6-3.2[	-	-	4	13	-	-	6	20
Very Good [3,2-3,6[	-	-	3	10	-	-	5	17
Excellent [3,6-4]	-	-	-	-	-	-	18	60
$\overline{X} \pm S$	0.38 ± 0.31		2.43 ± 0.46		0.49 ± 0.41		3.55 ± 0.49	

Note: Data obtained from the tests applied.

Table 5. Level of learning of descriptive statistics in students of the second cycle of the FEH-R/UNSM-T, according to the dimension "presentation"

Learning Level	Control Group				Experimental Group			
	Pre test		Post test		Pre test		Post test	
	N.	%	N.	%	N.	%	N.	%
Deficient [0-2[	30	100	12	40	30	100	-	-
Regular [2-2.6[	-	-	14	47	-	-	1	3
Good [2.6-3.2[	-	-	-	-	-	-	7	23
Very Good [3,2-3,6[	-	-	-	-	-	-	3	10
Excellent [3,6-4]	-	-	4	13	-	-	19	63
$\overline{X} \pm S$	0.23 ± 0.25		1.87 ± 0.97		0.73 ± 0.25		3.68 ± 0.48	

Note: Data obtained from the tests applied.

Table 6. Level of learning of descriptive statistics in students of the second cycle of the FEH-R/UNSM-T, according to the dimension "analysis for decision making".

Learning Level	Control Group				Experimental Group			
	Pre test		Post test		Pre test		Post test	
	N.	%	NO.	%	NO.	%	NO.	%
Deficient [0-2[	30	100	-	-	30	100	-	-
Regular [2-2.6[	-	-	16	53	-	-	3	10
Good [2.6-3.2[	-	-	9	30	-	-	10	33
Very Good [3,2-3,6[	-	-	5	17	-	-	7	23
Excellent [3,6-4]	-	-	-	-	-	-	10	33
$\overline{X} \pm S$	0.30 ± 0.43		2.77 ± 0.45		0.24 ± 0.43		3.40 ± 0.52	

Note: Data obtained from the tests applied.

Table 7. Comparative analysis of averages of descriptive statistics learning, according to post-test of the control and experimental groups.

Group post-test	Variable Learning descriptive statistics	Dimensions				
		R	T	P	Pr	A
Control	11.83	2.54	2.25	2.43	1.87	2.77
Experimental	17.60	3.28	3.68	3.55	3.68	3.40
Increase	5.77	0.74	1.43	1.12	1.81	0.63

Note: R= Collection; T=Tabulation, P=Processing, Pr=Presentation, A=Analysis.

The implementation of the research project method as a pedagogical strategy for teaching descriptive statistics in the Faculty of Education and Humanities has shown a significant impact on student learning, as evidenced by the results obtained. This study has shown that 67% of the students in the experimental group reached an excellent learning level, a remarkable improvement compared to 73% of the control group that only reached a regular level.

These results are consistent with the literature suggesting that active, learner-centered methods improve understanding and retention of statistical knowledge (Yusra and Najwa, 2024; Gul and Karacay, 2024). In addition, the significant difference in average performance between the experimental and control groups, validated by a t-value of 17.09, strongly supports the hypothesis that the research project methodology facilitates deeper and more applied learning of analytical and critical skills, essential in the educational sciences.

The strategy not only improved the collection and processing of statistical data, but also strengthened students' ability to present and analyze these data effectively, crucial skills in an academic and professional context. For example, in the presentation dimension, students in the experimental group exhibited advanced proficiency in data schematization and appropriate graphing, with an average learning score that increased from 1.87 to 3.68 points.

These findings underscore the need to incorporate pedagogical methods that promote active interaction and student participation in the learning process. The effectiveness of this approach is particularly relevant in statistics education, where the ability to apply knowledge in real situations is fundamental.

In addition, the project method has proven to be an effective tool for improving statistical competencies in all dimensions assessed, suggesting its potential for implementation in other curricular areas. Future research could explore its application in different educational contexts and compare its effectiveness with other pedagogical methods.

CONCLUSIONS AND VALUE PROPOSITIONS

The study conducted at the Faculty of Education and Humanities of a public university in Peru has provided convincing evidence that the research project method as a pedagogical strategy significantly improves the learning of descriptive statistics among second cycle students. The results obtained indicated a remarkable increase in the scores of the experimental group compared to the control group, highlighting significant improvements in all the dimensions evaluated, including the collection, tabulation, processing, presentation and analysis of statistical data.

However, the study has some limitations that should be considered. The research focused only on a specific institutional setting, which could restrict the generalizability of the results to other universities or contexts. In addition, it was limited to assessing short-term outcomes, leaving a gap in terms of long-term retention of statistical knowledge. The existing literature has not yet sufficiently addressed the effectiveness of project-based teaching methods on intrinsic motivation and self-efficacy of students in diverse cultural contexts or with different learning styles. This underscores the need for broader and deeper research exploring these dimensions.

From a practical perspective, this study emphasizes the importance of implementing active and student-centered teaching methodologies. Educational institutions could benefit from integrating project methods into their curricula to enrich students' analytical and critical skills, effectively preparing them to face challenges in professional and academic environments. The research project method brings considerable value to statistical education. It promotes not only the improvement of analytical skills through practical applications, but also fosters collaboration and creativity among students. Moreover, its adaptability to different educational levels and areas of study makes it a flexible and attractive option for modernizing educational approaches.

For future research, it would be pertinent to explore the long-term effects of the project method on statistical knowledge retention and to expand the study to a wider variety of educational contexts to validate the consistency of the results. In addition, investigating the interaction between student motivation and project-based pedagogical methods could offer valuable insights for optimizing these pedagogical approaches.

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B. data research and statistical analysis:	20%	20%	20%	20%	20%
C. elaboration of figures and tables:	20%	20%	20%	20%	20%
D. drafting, reviewing and writing of the text:	20%	20%	20%	20%	20%
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