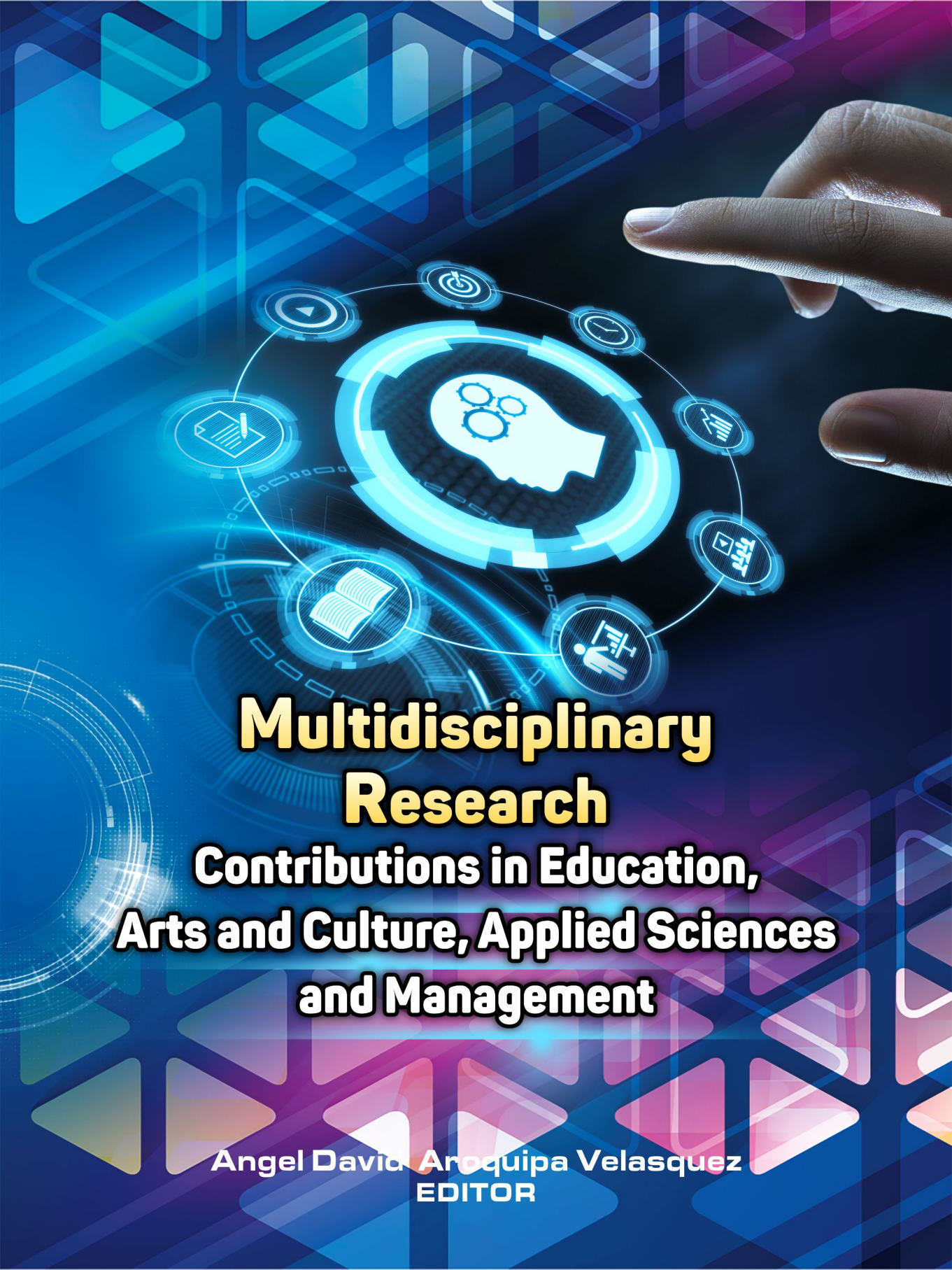




Multidisciplinary Research

Contributions in Education, Arts and Culture, Applied Sciences and Management

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Multidisciplinary Research Contributions in Education, Arts and Culture, Applied Sciences and Management

Universidad Nacional del Altiplano

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1.^a Edición mayo de 2026

Tiraje: 50 ejemplares

Depósito Legal N° 2026-04925

ISBN: 978-612-03-2461-5

Se terminó de imprimir en mayo de 2026 en:

LUCERO IMPRESIONES

RUC 10411509015

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PREFACE

Special recognition is hereby extended to the Language Program of the Graduate School at the National University of the Altiplano, Puno for its foundational support in the development of this scholarly work. The realization of this work was profoundly enriched by the participation of a distinguished, multidisciplinary assembly of experts, whose *collaboration* exemplifies the rigor of interdisciplinary academic inquiry. Their specialized expertise was indispensable in securing the editorial excellence and linguistic refinement of this publication, titled “*Multidisciplinary Research Contributions in Education, Arts and Culture, Applied Sciences and Management*”.

Establishing a scholarly identity aligned with international standards requires more than fundamental linguistic ability; it demands a sophisticated command of critical thinking, nuanced paraphrasing, and clear discursive expression. These advanced competencies are especially vital when authoring or translating academic works in a secondary language. By fostering these rigorous attributes, the Graduate School effectively fulfills its mandate to equip researchers for impactful scholarly inquiry and the advancement of both theoretical and applied knowledge.

On behalf of the Language Program, it is a distinct honor to present Multidisciplinary Research Contributions in Education, Arts and Culture, Applied Sciences and Management—a scholarly compilation of twenty-seven original studies exploring a dynamic spectrum of contemporary issues. The research is strategically organized into three thematic pillars: (I) Educational and Behavioral Sciences; (II) Music, Culture and Artistic Pedagogy; and (III) Applied Sciences and Institutional Management. Each contribution underscores a profound commitment to methodological rigor and illustrates the vibrant diversity of inquiry within our graduate community. This compendium stands as a testament to the intellectual dedication of the contributing professionals, whose efforts catalyze both regional development and national academic progress. It is our hope that this volume serves as a vital reference, fostering continued interdisciplinary dialogue and innovative discovery.

This work constitutes a significant academic contribution, reflecting the intellectual commitment and valuable efforts of the professionals involved. Their dedication supports both regional development and the advancement of national scholarship. It is our sincere hope that this contribution will serve not only as a rigorous and authoritative academic reference, but also as a source of inspiration for interdisciplinary collaboration, sustained scholarly dialogue, and the continuous expansion of knowledge. By integrating diverse perspectives and research endeavors, this work seeks to contribute meaningfully to the ongoing pursuit of excellence within the academic community.

Sc.D. Ángel David Aroquipa Velásquez

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Education and Behavioral Sciences



Learning strategies and research skills in students of a university in Puno

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ABSTRACT

The study aimed to determine the relationship between learning strategies and research skills in students of a university in Puno. In addition, the levels of both variables were analyzed to provide a broader understanding of the study context. The research was developed with a quantitative approach, applied type, correlational level, and non-experimental cross-sectional design. Questionnaires were administered through a survey, and the data were analyzed using Spearman's Rho coefficient. Regarding learning strategies, most students were at a medium level (65.22%), reflecting an acceptable but still insufficient use of cognitive and metacognitive strategies, since their application is not constant or fully developed in academic practice. As for research skills, a medium level (43.48%) was predominant, followed by a low level (34.78%), showing that a significant proportion of students present difficulties in essential research skills such as analysis, organization of information, and methodological management, which limits their academic performance in research work. Likewise, a high positive relationship was found between learning strategies and research skills ($\rho = 0.858$; $p = 0.000$). The study concludes that greater development and application of learning strategies are associated with higher levels of research skills in students, demonstrating that both variables are interconnected and contribute to better academic training.

Keywords: Learning strategies, research skills, university students

I. Introduction

The present study addresses the problem of limited research skills and the insufficient application of learning strategies among university students, a situation that becomes more evident in the final stages of their studies, when they must prepare theses or research reports. Despite their advanced academic level, many students show deficiencies in essential abilities such as problem formulation, theoretical construction,

and information synthesis, which limits their academic and professional performance (Mora & Lara, 2021). This situation highlights the need to implement specific pedagogical strategies that strengthen both autonomous learning and research skills, which are essential in the university context (Berrocal et al., 2024).

In this sense, universities are called to train professionals capable of producing information in a critical and rigorous way, where learning strategies and research skills are fundamental pillars of higher education, as they allow interpreting, analyzing, and transforming information into meaningful knowledge (Urbina, 2026). At a global level, these strategies are based on cognitive psychology and socio-constructivist models that strengthen metacognition, self-regulation, and motivation (Carranza, 2025), their application is evident in universities in Europe, America, and Latin America through meaningful learning, information organization, and the use of technologies to improve academic performance (Arzuaga et al., 2023). In line with this, research skills have become a central focus, as they require students to process scientific information, design projects, and solve social problems (Leal & Rodríguez, 2024), progress has been observed in countries such as Cuba, Colombia, Mexico, Brazil, Ecuador, and Peru, although gaps between teaching and research training still persist (Torres et al., 2025).

In line with what has been stated, active methodologies such as project-based learning, problem-based learning, and the use of virtual platforms strengthen research skills in global contexts (Díaz et al., 2025), highlighting the role of the teacher as a mediator in scientific training (Cupare & Resplandor, 2023). Following this same line, universities in Puno and southern Peru seek to strengthen their research practices in accordance with science and innovation policies (Segovia & Núñez, 2025), although there are still limited studies that analyze the relationship between learning strategies and research skills in regional contexts (Rojas et al., 2026).

Currently, it is observed that a large number of university students lack effective study techniques, resorting to unsystematic methods or methods with limited success, which affects the fulfillment of academic demands. Cedeño (2020) points out that it is essential for teachers to promote learning strategies that stimulate curiosity and critical thinking, which are fundamental aspects to strengthen research skills. At an international level, Segarra (2020) found that only 37% of university students feel confident in their research abilities, while 58% stated that they had developed a project, 82.9% highlighted the importance of these skills, and 90.4% recognized their impact in the workplace; however, only 21% of young people aged 16 to 24 in regions such as Asia, Europe, and the United States reported having data management skills, which reflects a concerning deficit (Sánchez & Rodríguez, 2023).

In Latin America, the situation is not different. Bernabé et al. (2022) found that 61.8% of university students perceive their methodological skills as average, and 55.6% recognize weaknesses in searching for scientific information. In addition, 84.8% of

graduates have never participated in conferences or published in journals, and 71.4% have not shared their findings with teachers or colleagues, which shows the low priority given to research in the region. This situation is consistent with what was described by (Ramos, 2021), who found that although 55% of students consider teaching strategies efficient, there is still 45% who perceive them as regular, suggesting the need to improve them to optimize research training.

In the same sense, Alva (2020) highlighted that 57.7% of postgraduate students recognize the importance of learning strategies for Problem-Based Learning, which is consistent with Bendayán (2023), who found that 73.3% of Psychology students were at a medium level of learning strategies. Likewise, Guerra (2023) identified that 82.4% of students showed a regular attitude toward research, while Vilcapoma (2022) found that 63.8% of Medical students reached a medium level in research skills. For his part, Cabezas (2022) showed that the search for information in electronic databases was above average, while in printed sources it was deficient, reflecting an unequal use of research resources. Finally, Güere (2022) confirmed that there is a positive relationship between research skills and critical thinking, reaffirming that these dimensions are closely interconnected. All these findings allow us to understand that learning strategies and research skills are interdependent dimensions, whose strengthening is essential to ensure comprehensive university education. In this context, the present research aims to understand this relationship in university students from Puno, considering the importance of metacognition, motivation, and active methodologies (Chumpitaz, 2025), providing local evidence that aligns with international trends and strengthens research culture (Hernández et al., 2021).

II. Methodology

The study adopted a quantitative approach, applied type, and correlational level, since it aims to determine whether there is a relationship between the variables learning strategies and research skills in a specific population. Likewise, it was developed with a non-experimental and cross-sectional design, since the data were collected at a single moment, directly from the study subjects, without manipulating the variables.

The population consisted of ninth and tenth semester students from the Professional School of Accounting of a university in Puno. From this population, a sample of 23 students was selected through non-probabilistic convenience sampling, considering the accessibility and availability of the participants.

For data collection, the survey was used as a technique and the questionnaire as an instrument. Two questionnaires validated by expert judgment were used: the learning strategies questionnaire developed by Román & Gallego, with 54 items, and the research skills questionnaire by Cabrera (2013), with 26 items, both with a Likert-type scale.

Regarding data analysis, descriptive statistics (frequencies, percentages, and measures of central tendency) were applied to characterize the levels of each variable. Likewise, a normality test was performed, obtaining non-parametric results. Therefore, to examine the relationship between learning strategies and research skills, Spearman's correlation test was used, due to the non-parametric distribution of the data, the small sample size, and the ordinal nature of the variables. Statistical processing was carried out using Microsoft Excel and SPSS programs.

III. Results and Discussion

3.1. Results

To identify the level of learning strategies among students, a descriptive analysis was carried out considering the categories low, medium, and high. This analysis made it possible to recognize how students use cognitive, metacognitive, and organizational strategies during their academic process, providing an overview of their current performance. The results obtained are presented below in Table 1.

Descriptive results of learning strategies:

Table 1

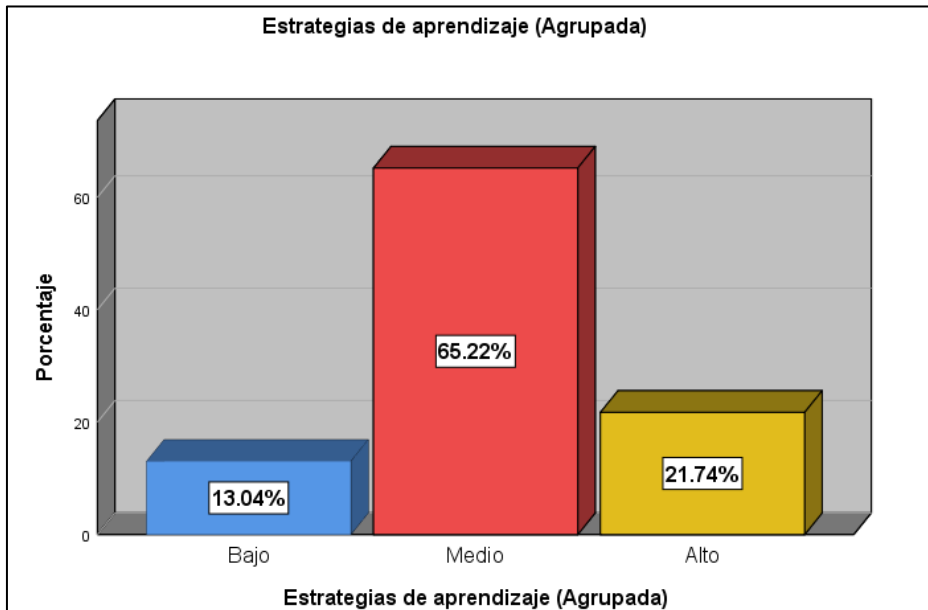
Distribution of learning strategies levels in students

		Frequency	Percentage	Valid	Cumulative
Valid	Low	3	13.0	13.0	13.0
	Medium	15	65.2	65.2	78.3
	High	5	21.7	21.7	100.0
	Total	23	100.0	100.0	

It is observed that 65.2% of the students are at a medium level of learning strategies, which indicates that they use these strategies partially, without fully consolidating them in their study process; meanwhile, 21.7% reach a high level, showing an adequate, organized, and constant use of strategies that support their learning; while 13.0% are at a low level, which reflects difficulties in applying strategies, limiting their ability to understand, organize, and make use of academic information.

Figure 1

Percentage of students according to levels of learning strategies



Descriptive results of research skills:

To determine the level of research skills among students, a descriptive analysis was conducted considering the categories low, medium, and high. This made it possible to identify the degree to which students develop abilities related to analysis, information management, problem formulation, and methodological application in the academic field. The results obtained are presented below in Table 2.

Table 2

Distribution of research skills levels in students

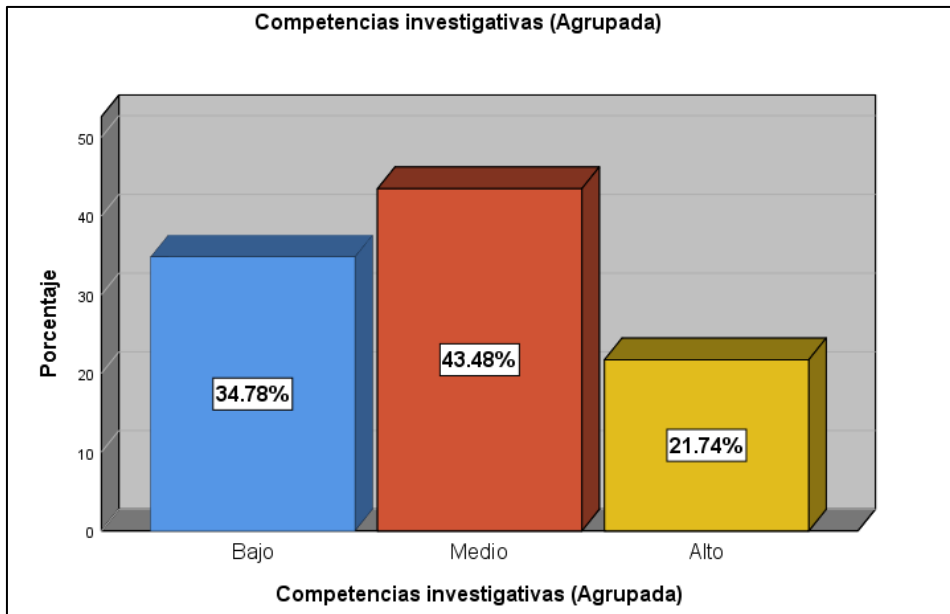
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Low	8	34.8	34.8	34.8
	Medium	10	43.5	43.5	78.3
	High	5	21.7	21.7	100.0
	Total	23	100.0	100.0	

It is observed that 43.5% of the students are at a medium level of research skills, which reflects that they develop these skills partially, with limitations in processes such as problem formulation, analysis, and integration of information; meanwhile, 21.7%

reach a high level, showing an adequate mastery of research skills that allows them to formulate, analyze, and support information with greater rigor; while 34.8% are at a low level, which indicates significant difficulties in the development of research skills, affecting their ability to understand, structure, and produce academic knowledge.

Figure 2

Percentage distribution of research skills levels in students



Correlational results:

To determine the relationship between learning strategies and research skills, an inferential statistical analysis was conducted using Spearman's correlation test, since the data did not follow a normal distribution. This procedure made it possible to identify the degree and direction of association between both variables, considering the ordinal nature of the data and the study sample. The results obtained are presented below in Table 3.

Table 3

Spearman correlation between learning strategies and research skills in students

Correlations				
			Learning strategies	Research skills
Rho de Spearman	Learning strategies	Correlation coefficient	1.000	.858**
		Sig. (two-tailed)	.	.000
		N	23	23
	Research skills	Correlation coefficient	.858**	1.000
		Sig. (two-tailed)	.000	.
		N	23	23

** . The correlation is significant at the level 0,01 (two-tailed).

A high positive correlation is observed between learning strategies and research skills ($Rho = 0.858$; $p = 0.000$), which indicates that as students strengthen the use of learning strategies, they also further develop their research skills. This result shows a direct and significant relationship, where better use of strategies such as organization, understanding, and analysis of information is associated with greater abilities to research, formulate problems, and support knowledge in a rigorous way

3.2. Discussion

Regarding the results of learning strategies, it is observed in the table 1 that most students (65.22%) were at a medium level of learning strategies, which indicates that although they apply certain techniques to organize and process information, they have not yet fully consolidated them in their academic practice. Likewise, a 21.74% reached a high level, showing a small group that demonstrates a constant and effective use of cognitive and metacognitive strategies. On the other hand, 13.04% were at a low level, which reflects deficiencies in the use of resources that support autonomous learning and critical understanding of the content. These results are similar to the study by Bendayán (2023), who found that in Psychology students from a private university in Lima, 73.3% presented a medium level of learning strategies, followed by 22.5% at a high level and 4.2% at a low level. Similarly, in the present research, the medium level was predominant (65.22%), followed by the high level (21.74%) and, to a lesser extent, the low level (13.04%). In both cases, it is confirmed that most students use learning strategies in an acceptable way, although there are still groups that need to strengthen their habits and techniques. In the same way, the findings are similar to those reported by Guerra (2023), where undergraduate students from a private university in Lima showed that the majority (82.4%) had a regular attitude toward research, 16.5% had a high attitude, and only 1.2% had a low attitude. Although this is a different variable, the trend is consistent with this study in terms of the predominance of intermediate levels, followed by a small group with high levels and a minority with low levels.

Likewise, the results are related to those found by Ramos (2021), who reported that in undergraduate students from a university in Lima, 55.0% perceived teaching strategies as efficient, while 45.0% considered them regular. As in this study, it is observed that most students recognize or apply strategies in a positive way, although there is a considerable percentage that perceives limitations, which shows the need to strengthen teaching and learning practices. Finally, there is some similarity with Cabezas (2022), who in the Faculty of Engineering of a public university in Lima found that indicators such as learning outcome reports and evaluation methods reached means above the median, while statements and types of activities were below it. Although this is the least similar study, it coincides in highlighting that teaching and learning strategies are not applied in a uniform way, and that there are weak aspects that need to be strengthened to improve the training process.

Regarding research skills shown in Table 2, it is observed that most students (43.48%) were at a medium level of research skills, which indicates an acceptable management of abilities such as information analysis, problem formulation, and methodological application. However, 34.78% reached a low level, which reflects limitations in the understanding and execution of research processes, an aspect that may affect the development of their academic work. Meanwhile, 21.74% reached a high level, showing a small group with a solid mastery of these skills. These results are similar to the study by Vilcapoma (2022), who in interns from the Faculty of Medicine of a public university in Lima found that 63.8% reached a medium level of research skills, followed by 20.3% at a high level and 15.9% at a low level. Similarly, in this study, the medium level was predominant (43.48%), with a small group at a high level (21.74%) and a considerable proportion at a low level (34.78%). Both studies agree that most students are concentrated at an intermediate level of research skills, although there are still significant gaps that need to be addressed. These results are also similar to those reported by Bendayán (2023), who found that 67.5% of students presented a regular level of research skills, 24.2% a good level, and 8.3% a deficient level. In this case, as in the present research, there is a tendency toward intermediate levels, with a smaller group at higher levels and another reduced group with difficulties, which reinforces the need to strengthen research training during undergraduate studies. Likewise, there are similarities with the study by Ramos (2021), where 68.8% of students were at a regular level of research skills and 31.3% at a good level. As in this study, most remain at a medium level, with a smaller group achieving good performance, reflecting progress, although there is still a need to consolidate these skills in a larger number of students. On the other hand, the results are partially related to what was indicated by Alva (2020), who identified that 62.2% of students from the Second Specialization in Educational Technology considered that cognitive dispositions are decisive in the development of research skills, while 30.8% thought otherwise. Although this is a different analysis, it agrees with this study in that cognitive aspects and learning strategies are fundamental for strengthening these skills. Finally, there is some relation with what was described by Cabezas (2022), who in the

Faculty of Engineering of a public university in Lima reported that the indicators of the information search dimension showed unequal behavior: the search in books and journals obtained a low mean (1.79), below the median, while the search in electronic databases reached a high mean (7.55), above the median. Although this study addresses specific dimensions, it agrees with the present research in indicating that research skills are not developed in a uniform way, which suggests the need to strengthen both access to digital sources and the ability for critical analysis of printed academic information.

Regarding the relationship between the study variables, Table 3 shows that the correlation between learning strategies and research skills was $\rho = 0.858$, with a two-tailed significance level of $p = 0.000$, which is lower than 0.01. This result shows a high positive relationship, meaning that students who more frequently use learning strategies tend to further develop their research skills. These results are similar to those found by **Bendayán (2023)**, who in Psychology students from a private university in Lima found a Spearman correlation coefficient of 0.709 with a significance of 0.000, showing a high positive relationship between learning strategies and research skills. Similarly, in the present study, a coefficient of $\rho = 0.858$ with $p = 0.000$ was obtained, indicating a positive and stronger correlation, which confirms that the effective use of learning strategies is directly associated with better development of research skills. These findings are also similar to those reported by **Ramos (2021)**, who in undergraduate students from a university in Lima found a Spearman correlation coefficient of 0.515 with a significance of 0.000, reflecting a positive and moderate relationship between teaching strategies and research skills. Although the coefficient was lower than the one obtained in this study, both results agree on the importance of applying appropriate strategies to strengthen research skills in the university context. As in this research, it is confirmed that academic strategies influence the development of research skills, although in the case of Cabezas the relationship was of lower intensity. In addition, the results are consistent with what was presented by **Guerra (2023)**, who when analyzing the relationship between attitude toward research and research skills in undergraduate students from a private university in Lima reported a Rho index of 0.418 with a significance of 0.000, concluding that the relationship was positive and moderate. This finding, although related to another variable, is linked to the present study as it reaffirms that academic and attitudinal factors have a significant impact on the development of research skills. Although the coefficient is low compared to this study (0.858), both confirm the existence of a direct and significant relationship with research skills. Finally, the findings show some relation with what was indicated by **Alva (2020)**, who when analyzing the application of Problem-Based Learning as a teaching strategy in students of the Second Specialization Program in Educational Technology identified that 57.7% of students considered it important for strengthening research skills, while 49.2% did not recognize it as a relevant resource. Although no correlation coefficient is reported, the study agrees with the present one in highlighting that strengthening specific strategies favors the development of research skills.

IV. Conclusions

The analysis of learning strategies showed that most students (65.22%) are at a medium level, which reflects an acceptable but still insufficient use of cognitive and metacognitive techniques. This finding helps to understand that the problem does not lie in the absence of strategies, but in their partial and unsystematic application, which limits students' autonomous and critical learning.

Regarding research skills, it was found that 43.48% of students are at a medium level and 34.78% at a low level, which reveals a significant weakness in the development of fundamental skills for academic research. This result helps to understand that the deficit in research skills is not isolated, but responds to structural gaps in training that require urgent attention in the university educational process.

The high positive correlation between learning strategies and research skills ($p = 0.858$, $p = 0.000$) is the most relevant finding of the study, as it shows that improving the use of learning strategies directly strengthens research skills. This result provides a deeper understanding of the problem, confirming that both variables should not be addressed separately, but as interdependent components that, when integrated, can transform academic training and enhance students' scientific production.

Ethics statement

The present research complied with fundamental ethical principles throughout all stages of the study. Respect for the rights of participants was ensured, guaranteeing their voluntary participation through informed consent, as well as the confidentiality and anonymity of the collected information. Likewise, the data obtained were used exclusively for academic and scientific purposes, acting with transparency, responsibility, and methodological rigor, without manipulation of results or harm to the participating students.

Acknowledgment

Special thanks are extended to the university for the support provided for the development of the research. Likewise, thanks are given to the participating students, who collaborated voluntarily and responsibly, allowing the collection of the necessary information to achieve the objectives of the study

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Effect of GeoGebra Use on the Achievement of Mathematical Competencies in Lines and Conic Sections among University Students in Cusco, Perú

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ABSTRACT

Mathematics education in higher education increasingly demands innovative pedagogical approaches to improve student learning outcomes. Limited evidence exists regarding the effect of dynamic software tools such as GeoGebra on mathematical competency achievement in Peruvian university contexts. This study aimed to determine the effect of GeoGebra software on the achievement of competencies in lines and conic sections among university students in Cusco, Peru, 2020. A quantitative, applied, quasi-experimental design was implemented, involving 60 undergraduate students from four professional schools of the Faculty of Agricultural Sciences at Universidad Nacional de San Antonio Abad del Cusco, randomly selected as intact groups. The experimental group ($n=30$) received instruction using GeoGebra, while the control group ($n=30$) followed traditional expository teaching methods. Pre-test and post-test assessments were administered to both groups to verify initial knowledge homogeneity and measure competency achievement. Data collection instruments were validated through expert judgment, obtaining an average validity of 90% (excellent level), and reliability was established using Cronbach's alpha coefficient ($\alpha=0.835$), indicating high reliability. Results based on Student's t-test at 95% confidence level ($p<0.05$) demonstrated that GeoGebra use significantly improved competency achievement in lines and conic sections by 3.33 and 3.77 points, respectively. Improvements were also evidenced across cognitive, procedural, and attitudinal dimensions. These findings confirm that the systematic integration of GeoGebra as a didactic tool significantly enhances mathematical competency achievement among university students.

Keywords: Academic achievement, GeoGebra; higher education; lines and conic sections; mathematical competencies

I. Introduction

The teaching of mathematics in higher education faces various challenges associated with the understanding of abstract content, particularly in topics such as lines and conic sections, which require high levels of reasoning and spatial visualization. In this context, the development of mathematical competencies has become a fundamental axis of university education. In this regard, Bonilla (2023) points out that mathematical competencies include the construction of numerical, metric, spatial, random, and variational thinking, with sociocultural meaningful learning being the most prevalent approach in mathematics teaching. Complementarily, Barrios and Delgado (2022) affirm that the use of technological resources in mathematics learning generates positive effects on students' academic performance, fostering the development of cognitive and procedural skills essential for university education.

In this line, meaningful learning emerges as a pedagogical alternative to improve the understanding of abstract mathematical content. Moreira (2019) argue that this type of learning enables students to generate new ideas and develop the ability to interpret and acquire knowledge, with information and communication technologies serving as a fundamental pillar in the contemporary teaching-learning process. In the same direction, Grisales (2018) states that the teaching-learning process of mathematics requires updating teaching methods by incorporating new strategies and technologies in order to foster student motivation and lead them to recognize the scope of mathematics in professional and practical contexts. Santillán et al., (2023) demonstrated that the use of specialized software in teaching and learning processes enhances mathematical competencies and enables students to consolidate their ability to formulate and solve mathematical problems.

On the other hand, the integration of information and communication technologies into mathematics teaching has gained relevance as a didactic tool in higher education. Flores et al. (2021) indicate that the use of technology-supported educational software aims to improve student performance and promote meaningful learning, serving as a source of motivation in the mathematical learning process. In the same direction, Michilena and Pazmiño (2024) validated that educational strategies based on digital resources provide greater innovation, relevance, and participation in mathematics learning compared to traditional methods. Similarly, Ñáñez et al., (2025) highlight that both virtual environments and educational software enhance student motivation and promote better alignment with modern learning strategies.

In this context, the software GeoGebra has been established as a widely used dynamic geometry tool in mathematics education worldwide. Abera and Awgichew (2019) note that GeoGebra possesses features such as its dynamic nature, user-friendly design, multiple representations, and open accessibility, which make it an effective and preferred tool for mathematical learning. Hernández et al., (2021) emphasize that the use of GeoGebra in mathematics teaching facilitates content comprehension and the

development of visual and interactive skills in students. Likewise, Gurmu et al., (2024) highlight that GeoGebra displays equations of conic sections, lines, and slopes during geometric construction, facilitating conceptual understanding through the interactive visualization of abstract mathematical objects. In the same line, Fiangga and Sari, (2024) investigated the use of GeoGebra to support university students' reasoning about conic sections, designing activities based on inductive construction that enhance spatial orientation and mathematical visualization, demonstrating the potential of this tool for learning analytic geometry in higher education.

The accumulated empirical evidence on the effect of GeoGebra in mathematics learning is significant and consistent. Juandi et al. (2021), in a meta-analysis of 29 primary studies, identified that the overall effect size of GeoGebra on mathematical skills was 0.96, indicating that students exposed to GeoGebra-based learning consistently outperformed their peers in traditional classrooms. Complementarily, Morales et al., (2023), in a systematic review of studies published between 2011 and 2022, concluded that there is a predominance of GeoGebra use in the development of mathematical skills, evidencing its positive impact on mathematics learning across different educational contexts. Likewise, Ndagijimana et al., (2024), in a quasi-experimental study with 279 students, confirmed that GeoGebra significantly improves conceptual understanding of points, lines, and angles compared to traditional teaching. However, at the national and Latin American levels, there is still limited integration of these technological tools in university teaching, which affects the low levels of achievement in mathematical competencies (Flores et al., 2021).

At the Universidad Nacional de San Antonio Abad del Cusco, competency-based education constitutes a central axis of the educational process. However, it is observed that many students experience significant difficulties in learning lines and conic sections, which limits their academic performance in analytic geometry courses. Therefore, it is necessary to incorporate technological tools such as GeoGebra to improve the achievement of mathematical competencies in these topics. In this sense, the present study aims to determine the effect of the use of GeoGebra on the achievement of competencies in lines and conic sections among university students in Cusco, providing empirical evidence within the context of Peruvian higher education.

Mathematical competence in higher education encompasses cognitive, procedural, and attitudinal dimensions that must be developed in an integrated manner (Bonilla, 2023; Barrios & Delgado, 2022). The PISA 2022 mathematics framework defines mathematical literacy through four cognitive processes: reasoning, formulating, employing, and interpreting; organized into content domains that include space and shape (OECD, 2023). In analytic geometry, these competencies are particularly demanding due to the high level of abstraction involved.

The theoretical foundations of this study are based on meaningful learning and constructivism. Ausubel argued that students should be taught in relation to what they

already know; Bruner promoted discovery learning, through which students construct their own knowledge; and Vygotsky's zone of proximal development describes how students acquire scientific concepts through interaction with teachers and more capable peers (Bryce & Blown, 2023). These ideas are directly connected to the use of technology in the design of interactive learning environments, where the teacher's role is oriented toward facilitating exploration within the zone of proximal development (Rigopouli et al., 2025). When dynamic software is integrated into instruction, these constructivist principles are operationalized by allowing students to manipulate mathematical objects and build understanding through guided discovery. In this context, GeoGebra has become the most widely used dynamic mathematics tool in university instruction. GeoGebra is a dynamic, user-friendly, and open-source software that connects geometry with algebra; by reducing the demands of abstraction and procedures, it facilitates students' conceptual understanding (Sebsibe & Abdella, 2025). It integrates dynamic geometry and computer algebra within a single environment that allows the construction of points, lines, and conic sections, promoting mathematical exploration and multiple representations (Hohenwarter & Fuchs, 2004). GeoGebra enables students to carry out mathematical investigations interactively, turning them into active agents in the knowledge construction process, through features such as multiple representations, online accessibility, and a global user community (Yohannes & Chen, 2023).

II. Methodology

The study was conducted under a quantitative approach with an applied scope, aiming to evaluate the effect of the use of GeoGebra on the achievement of competencies in lines and conic sections among university students. A quasi-experimental design with non-equivalent groups was employed, consisting of an experimental group and a control group, following a pretest–posttest structure that allowed the assessment of changes attributable to the intervention. In this context, the following hypotheses were formulated: H_0 : there are no significant differences in competency achievement between the groups; H_1 : there are significant differences in favor of the experimental group.

The population consisted of students from the Faculty of Agricultural Sciences at the Universidad Nacional de San Antonio Abad del Cusco. The sample included 60 students selected through non-probabilistic sampling and organized into two intact groups: an experimental group ($n = 30$) and a control group ($n = 30$). The experimental group developed learning activities using GeoGebra over a period of eight weeks, while the control group followed a traditional expository teaching method.

Data were collected through an achievement test in analytic geometry, administered as both pretest and posttest, which allowed the measurement of competency achievement across cognitive, procedural, and attitudinal dimensions. The evaluation was conducted using a vigesimal scale (0–20 points). The instruments were validated through expert

judgment (90% validity) and demonstrated high reliability (Cronbach's alpha $\alpha = 0.835$).

The procedure consisted of three phases: administration of the pretest, implementation of the pedagogical intervention, and administration of the posttest. Additionally, a prior analysis of equivalence between the experimental and control groups was conducted based on pretest results to verify that no significant differences existed in the initial levels of knowledge. This procedure ensured the comparability of the groups before the intervention. Likewise, consistency in the implementation of the instructional strategy was controlled, ensuring that the content, teaching time, and evaluation conditions were similar in both groups, except for the incorporation of GeoGebra in the experimental group.

For data analysis, Student's t-test for independent samples was applied, after verifying the assumptions of normality and homogeneity of variances, with a confidence level of 95% ($p < 0.05$). This allowed the identification of statistically significant differences and the attribution of the observed effects to the use of GeoGebra as the independent variable.

III. Results and discussion

3.1. Results

The results of the present study are presented in an organized manner, considering the comparison between the experimental and control groups, based on the scores obtained in the pretest and posttest, as well as the analysis by dimensions of competency achievement in lines and conic sections.

Regarding the **pretest results**, both groups showed similar levels of competency achievement, which allowed the establishment of equivalent initial conditions. The average scores obtained by the experimental and control groups did not show significant differences, indicating homogeneity in prior knowledge related to the evaluated contents. After the pedagogical intervention, the **posttest results** were analyzed, showing differences between both groups. The experimental group, which used the GeoGebra as a learning tool, obtained higher scores compared to the control group, which followed a traditional expository method.

In the specific case of **lines**, the experimental group showed an average increase of 3.33 points compared to the pretest results, while the control group showed a smaller increase, reflecting differences in academic performance. Similarly, in **conic sections**, the experimental group achieved an average increase of 3.77 points, whereas the control group presented less significant variation. These findings reflect an improvement in the academic performance of students who participated in the intervention. Likewise, the analysis by dimensions showed improvements in the **cognitive, procedural, and attitudinal** levels in the experimental group. In the

cognitive dimension, higher levels of conceptual understanding were observed; in the procedural dimension, better performance in problem-solving; and in the attitudinal dimension, a greater disposition toward learning. In contrast, the control group showed less notable improvements in these dimensions.

Inferential statistical analysis was conducted using Student's t-test with a 95% confidence level. The results ($p < 0.05$) indicated statistically significant differences between the experimental and control groups in the posttest. Overall, the findings show variations in competency achievement in lines and conic sections between the evaluated groups, highlighting differences in academic performance after the intervention.

Table 1

Competency Achievement in Lines (pre test)

	Control group	Experimental group
Count	30	30
Mean	6,83333	7,33333
Standard deviation	1,76329	1,58296
Coefficient of variation	25,8043%	21,5858%
Minimum	4	4
Maximum	10	10
Range	6	6

The results show that the average score in the unit of lines for students in the control group was 6.83, with a standard deviation of 1.76 on a twenty-point scale. In the experimental group, before the application of GeoGebra, the average score was 7.33, with a standard deviation of 1.58. These results are similar, indicating that the study began with groups having comparable characteristics in terms of prior knowledge of lines, which supports the validity of the quasi-experimental design.

Table 2

Competency Achievement in Conic Sections (pre test)

	Control group	Experimental group
Count	30	30
Mean	6,9	6,23333
Standard deviation	1,51658	1,27802
Coefficient of variation	21,9793%	20,503%
Minimum	5,0	4,0
Maximum	11,0	9,0
Range	6,0	5,0

The results show that students in the control group obtained an average score of 6.9 with a standard deviation of 1.52, while the experimental group obtained an average score of 6.23 with a standard deviation of 1.28. These results are similar, indicating that both groups had comparable characteristics in terms of prior knowledge of conic sections, which supports the validity of the quasi-experimental design.

Table 3

Competency Achievement in Lines (post test)

	Control group	Experimental group
Count	30	30
Mean	14,5667	17,9
Standard deviation	1,04	1,09387
Coefficient of variation	7,13962%	6,11101%
Minimum	12	17
Maximum	17	20
Range	5	3

At the end of the development of the unit on lines, the control group obtained an average score of 14.56 with a standard deviation of 1.04; meanwhile, the experimental group that used the GeoGebra software achieved an average of 17.90 with a standard deviation of 1.09, improving by approximately 3.33 points compared to the average obtained by the control group, which did not use GeoGebra in their learning process on lines.

Table 4

Achievement of Competencies in Conics (post test)

	Control group	Experimental group
Count	30	30
Mean	14,5667	17,9333
Standard deviation	1,07265	0,980265
Coefficient of variation	7,36372%	5,46616%
Minimum	13	17
Maximum	16	20
Range	3	3

In the statistical table, the results obtained in conic sections after applying the teaching strategies are observed. In the control group, an average score of 14.57 was obtained with a standard deviation of 1.07, while in the experimental group where the GeoGebra software was applied, an average score of 17.93 was obtained with a standard deviation

of 0.98; this represents an increase of approximately 3.36 points compared to the average score of the students in the control group.

Table 5

Results in the Dimensions of Competency Achievement in Lines after the Application of GeoGebra Software

Statistics	Cognitive Dimension		Attitudinal Dimension		Procedural Dimension	
	Control group	Experimental group	Control group	Experimental group	Control group	Experimental group
Mean	14,40	17,0667	15,4333	18,2667	13,5333	18,40
Standard deviation	1,22051	1,46059	0,8172	1,14269	1,35782	1,32873
Coefficient of variation	8,48%	8,56%	5,30%	6,26%	10,03%	7,22%
Confidence Limits	[16,521; 17,6121]	[13,9443; 14,8557]	[15,1282; 15,7385]	[17,84; 18,693]	[13,026; 14,0404]	[17,9038; 18,8962]
p-value=0.0000		0,0000		0,0000		

From the Student's *t*-test at a 95% confidence level, it is concluded that the application of GeoGebra software in the cognitive dimension of lines improves students' academic performance ($p = 0.000 < 0.05$) by approximately 2.67 points. This is because students who did not use this strategy have an average achievement of 14.4, while those who used GeoGebra obtained an average of 17.07. In the attitudinal dimension, the academic performance of students in the control group averages 15.43 with a standard deviation of 0.8172, ranging between [15.1282; 15.7385]. In contrast, students who applied the GeoGebra software show an average academic performance of 18.27, with 95% of the values ranging between [17.84; 18.6934], representing an increase of approximately 2.84 points compared to the control group.

Table 6

Results in the Dimensions of Competency Achievement in Conics after the Application of GeoGebra Software

Statistics	Cognitive Dimension		Attitudinal Dimension		Procedural Dimension	
	Control group	Experimental group	Control group	Experimental group	Control group	Experimental group
Mean	14,2667	17,0667	15,4	18,80	13,5333	18,40
Standard deviation	1,36289	1,25762	1,00344	1,09545	1,25212	1,32873
Coefficient of variation	9,55%	7,37%	6,52%	5,83%	9,25%	7,22%
Confidence Limits	[13,7578; 14,7756]	[16,5971; 17,5363]	[15,0253; 15,7747]	[18,391; 19,209]	[13,0658; 14,0009]	[17,9038; 18,8962]
p-value=0,0000		0,0000		0,000		

Academic performance in the cognitive dimension for the control group, without the application of GeoGebra software in the conics unit, averages 14.27 with a standard deviation of 1.36. In contrast, in the experimental group where GeoGebra was applied in the learning process, students obtained an average academic performance of 17.06. Regarding the attitudinal dimension, the academic performance of students in the control group averages 15.4 and ranges between [15.0253; 15.7747]. Meanwhile, students who applied GeoGebra have an average of 18.8, ranging between [18.391; 19.209], representing an increase of approximately 3.4 points compared to the control group.

With respect to the procedural dimension, it is observed that students in the experimental group have an average academic performance of 18.40, ranging between [17.9038; 18.8962], which is approximately 4.87 points higher than that of the control group, whose average is 13.53 and ranges between [13.0658; 14.0009].

3.2. Discussion

The results demonstrate that the use of GeoGebra has a positive and statistically significant effect on the achievement of competencies in lines and conic sections among university students ($p < 0.05$), with mean differences of 3.33 and 3.77 points, respectively, in favor of the experimental group. These findings are consistent with Barrios and Delgado (2022) and Flores et al. (2021), who highlight that the incorporation of technological resources in mathematics learning generates positive effects on academic performance and promotes meaningful learning, as well as with Moreira (2019), since the use of GeoGebra facilitated the interaction and visualization of abstract concepts, enhancing students' capacity to interpret and acquire knowledge.

From a pedagogical perspective, the results support Grisales (2018) and Santillán et al. (2023), who emphasize the importance of integrating digital tools and specialized software to improve student motivation and strengthen problem-solving skills. In the same line, Michilena and Pazmiño (2024) and Ñáñez et al. (2025) confirm that educational strategies based on digital resources promote greater innovation and better alignment with contemporary learning approaches, which is reflected in the improved performance observed in the experimental group.

Regarding the specific role of GeoGebra, the improvements evidenced across the cognitive, procedural, and attitudinal dimensions are consistent with Hernández et al. (2021) and Gurmu et al. (2024), who highlight that this software facilitates content comprehension and the development of visual and interactive skills through the dynamic representation of lines and conic sections. Furthermore, Fiangga and Sari (2024) demonstrated that inductive activities based on GeoGebra enhance spatial orientation and mathematical visualization in analytic geometry, directly supporting the gains observed in the present study.

At the level of empirical evidence, the findings align with Juandi et al. (2021), whose meta-analysis of 29 studies identified an overall effect size of 0.96, confirming that students exposed to GeoGebra consistently outperform their peers in traditional classrooms. Complementarily, Morales et al. (2023) and Ndagijimana et al. (2024) corroborate, through a systematic review and a quasi-experimental study respectively, that GeoGebra has a positive and significant impact on the development of mathematical competencies and conceptual understanding of geometric content across diverse educational contexts.

From a theoretical standpoint, these results are grounded in the constructivist principles of Ausubel, Bruner, and Vygotsky, as described by Bryce and Blown (2023), since GeoGebra enabled students to construct knowledge through guided discovery and interactive manipulation of mathematical objects within their zone of proximal development. In this regard, Sebsibe and Abdella (2025) and Yohannes and Chen (2023) affirm that GeoGebra reduces procedural demands and turns students into active agents of their own learning, confirming that its systematic integration significantly enhances mathematical competency achievement in higher education.

IV. Conclusions

- Based on the Student's *t*-test at a 95% confidence level, the use of GeoGebra significantly improves students' achievement in lines and conic sections. The experimental group outperformed the control group by 3.33 points in lines and 3.77 points in conic sections, highlighting the effectiveness of visual and dynamic learning environments.
- GeoGebra also enhances cognitive learning, with mean differences of 2.67 points in lines and 2.8 points in conic sections. This improvement is attributed to better understanding of concepts through graphical visualization and interactive learning.
- A significant effect was observed in procedural learning, where the experimental group exceeded the control group by 4.87 points, indicating improved problem-solving skills, organization, and efficient use of time.
- Regarding the attitudinal dimension, GeoGebra had a positive impact on students' motivation and disposition toward mathematics, with increases of 2.84 points in lines and approximately 3.4 points in conic sections compared to the control group.

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Family violence and disruptive behaviors in Adolescents: A sistematic review

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ABSTRACT

Family violence and disruptive behaviors in the adolescent stage are relevant health. It has significant effects on emotional areas (experiencing anxiety, depression, and low self-esteem), behavioral areas (developing disruptive behaviors such as aggression, disobedience, and defiance of authority), and cognitive functions (impacting problem-solving skills and the ability to face daily challenges). This study aimed to synthesize the available scientific evidence on family violence and disruptive behaviors in adolescents. A systematic review was conducted using the PRISMA method, including searches in the SCIELO, DIALNET y REDALYC databases, based on the last 10 years, written in spanish, A total of 25 articles were identified, of which only 8 met the criteria to be included for analysis. Based on the results, five studies correspond to the correlational level, determines the functioning, desintegration, family violence and parenting practice have a direct incidence on disruptive behaviors, meanwhile three descriptive articles, Rebellion is considered will not depend on age and gender, but rather is more related to the absence of emotional support. It is concluded that family, social, and emotional factors, as well as age and gender are elements that influence the presence of disruptive behaviors.

Keywords: Disruptive behaviors, aggressive behaviors, family interaction, family violence

I. Introduction

Family violence is a global problem and presents a series of consequences at the physical, psychological, sexual, and social levels, historically, it affects millions of adolescents worldwide, According to the World Health Organization ([WHO], 2024) one in six adolescents has experienced some form of violence, The highest prevalence

rates are found in Oceania (47.0%), Africa (40.0%), Europe (10.0%), and Asia (11.0%) being the most affected regions. Latin America (58.0%) and North America (61.0%) (Pan American Health Organization [PAHO], 2024). Another more up-to-date statistic from the United Nations (2025) shows that in the last twelve months, 12.5 million adolescents suffered physical and sexual assault.

Family violence is determined by cultural, community, and familial factors, as well as self-perception. It manifests through physical, psychological, and sexual aggression, targeting the most vulnerable individuals within family contexts. (Quispelay et al., 2022). However, disruptive behaviors are manifested through shouting by parents or by those who have witnessed altercations between their parents, resulting in behaviors of fear, dread, or insecurity. (Mas et al., 2020). Adolescents living in a violent home experience repercussions at the emotional, cognitive, behavioral, and social levels (Faria et al., 2025).

Previous studies, based on a database of 21 reviewed articles, determined that authoritarian and permissive parenting styles influence the manifestation of disruptive behaviors, while the democratic style allows for the maintenance of normal dynamic behavior (Delgado & Campodónico, 2023). Meanwhile, another study of 18 articles, identified that 60.0% of adolescents live in violent family environments; the main manifestations being physical, verbal, and psychological abuse. Furthermore, violence has a significant impact on academic performance (Tupullima et al., 2023). Additionally, a study based on 26 reviewed documents in Latin America analyzed how violent behavior is linked to familial, social, and community actions, as well as individual beliefs (Moreno et al., 2024).

Family violence is a series of behaviors intended to cause harm at the physical, social, or psychological level to any family member (Rodríguez et al., 2022). Adolescents within a family nucleus characterized by any form of violence are the most severely affected in terms of psychosocial development. they experience negative changes within the family, feel insecurity and these shifts extend to their interactions with peers and neighbors, resulting in altered attitudes and personality traits, leading to more reserved or even socially isolated behaviors (Alay & Pibaque, 2024).

From the ecological theory perspective, violence can be learned in three areas. The first refers to the microsystem, which corresponds to the family context, where aggressive behaviors may be modeled by a family member. The second is the exosystem, which pertains to the social context in which one operates. The third refers to the macrosystem, which encompasses the cultural context, including the beliefs and values practiced. These contexts can interfere with the learning of violent behaviors (Flores, 2020). The violent environment at the family and social level in which adolescents grow up is more likely to teach them the same patterns employed by their parents as well as those in the social environment (Curo & Guerrero, 2024).

Disruptive behaviors are actions that interfere with normal functioning in family, academic, and social settings, directly affecting the well-being of the group in which the individual is situated (Campoverde & Ramos, 2025). One of the defining characteristics of these behaviors is the manifestation of opposition to established norms in an abrupt, aggressive, and impulsive manner (Zambrano et al., 2022). Disruptive behaviors can have an impact on social, family, and academic functioning. These behaviors can vary from disobedience and rebellion to substance abuse and verbal or physical aggression (Campoverde & Ramos, 2025).

Bandura's social learning theory posits that learning occurs through observation or imitation of a model. This process can be influenced by the context in which one operates. For this learning to take place, attention, motivation, attitudes, and the emotions displayed towards a behavior are necessary (Firmansyah & Saepuloh, 2022). During adolescence, disruptive behaviors are shaped by multiple social and cultural factors that negatively influence conduct, hindering the adherence to norms or rules across various contexts (Hernández et al. 2025).

As described, family violence and disruptive behaviors represent a significant concern within psychological research, particularly during adolescence. This line of inquiry not only contributes to academic knowledge but also provide insights that benefit society as a whole.

II. Methodology

The methodology corresponding to the study is a systematic review. The selection was limited to reviewed articles and journals that contribute to the understanding of the proposed topic (Ato et al., 2013).

The extraction of scientific journals and articles followed the PRISMA protocol, a method that ensures detailed reporting of the results of the systematic review and provides a more transparent description of the information to be extracted (Haddaway et al., 2022).

The search for articles drew on the SCIELO, DIALNET, and REDALYC databases, focusing on studies in Spanish published within the last 10 years (2015–2025). The search was conducted using keywords, which allowed for a general search, including terms such as (family violence, domestic violence, disruptive behaviors, behavioral problems, adolescence).

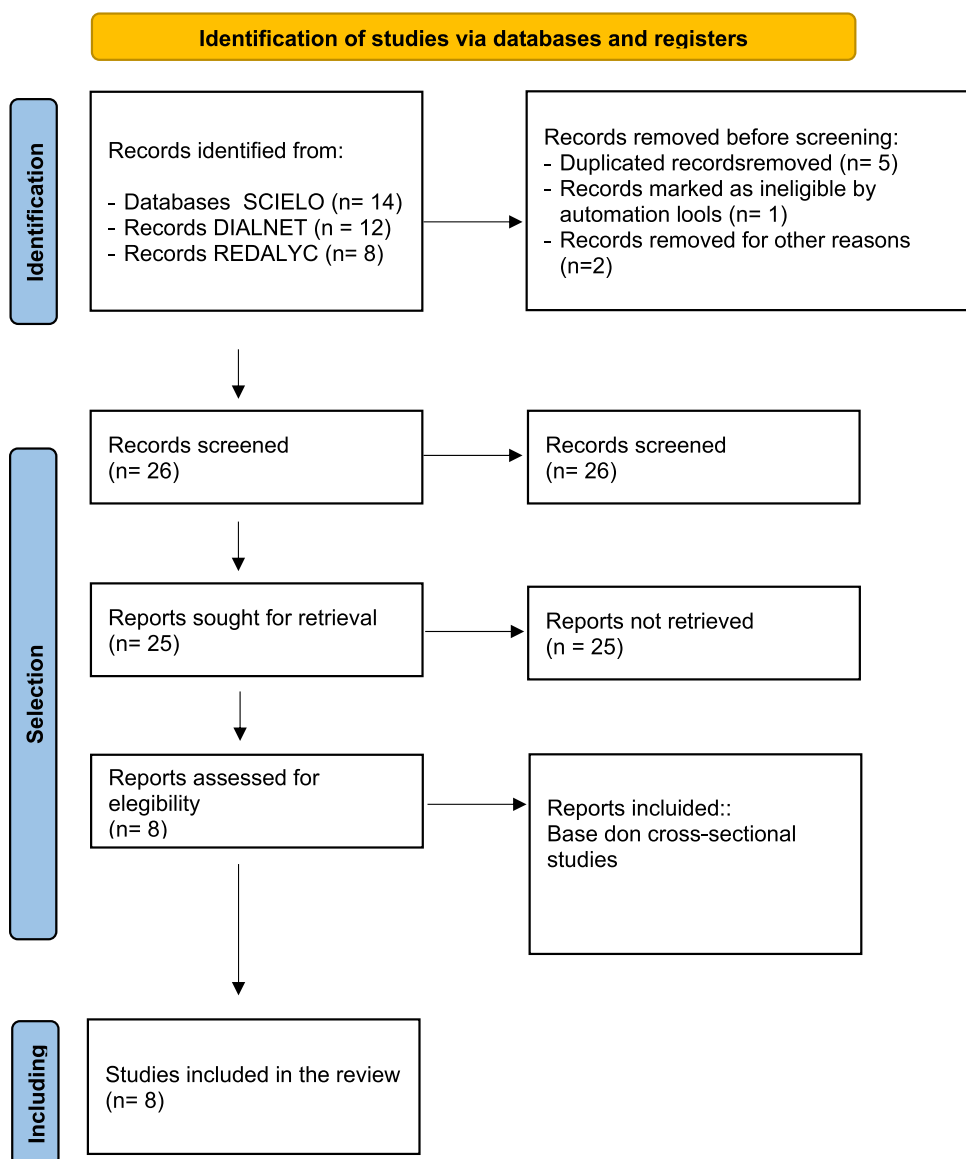
The keyword search yielded a total of 25 scientific articles that met the inclusion criteria: full-text studies published between 2015 and 2025, involving adolescent samples, and utilizing a quantitative, cross-sectional approach. The exclusion criteria included experimental or intervention studies. The selection process involved screening titles and abstracts to determine eligibility, resulting in a final sample of 8 articles for analysis.

Each selected study contains the following information: author, year, objective, research design, study population, and results. This dataset was organized using Microsoft Excel 2024. Once the data had been fully processed, a qualitative analysis of the included studies was conducted.

The following section presents the information matrix of the systematic review, detailing the selection process of the included studies.

Figure 1

PRISMA flow diagram, reporting elements of the study selection process



III. Results and discussion

3.1. Results

The initial search identified 25 articles related to the topic; after a more thorough review, only 8 articles were included. These are described in Table 1 below.

Table 1

Description of the characteristics of the included studies

Nº	Author	Objective	Research design	Population	Results
1	Becerra et al., (2025)	To determine the relationship between family violence and disruptive behaviors in adolescents	Quantitative, cross-sectional approach	32 students	When adolescents are in a violent family context, disruptive behaviors are likely to increase
2	Luján et al., (2019)	The study sought to determine whether family functioning is related to disruptive behavior	The design in question is a non-experimental, correlational design	It was made up of 174 middle school students in the fourth and fifth grades	It was determined that there is a low and inverse relationship between family functioning and disruptive behavior ($p = .000$)
3	Arnao et al. (2024)	It was proposed to analyze whether family disintegration correlates with disruptive behaviors	It corresponds to a cross-sectional correlational design	40 students aged 14 to 17	Family disintegration is significantly correlated with disruptive behavior ($p = .042$)
4	Barros et al. (2025)	To identify whether parenting styles demonstrate a relationship with disruptive behaviors	Cross-sectional, correlational design	225 adolescents	Parenting style can lead to significant changes in disruptive behaviors ($\rho = .334$).
5	Rodríguez et al. (2025)	To determine whether parenting practices are related to disruptive behaviors	The methodology follows a cross-sectional design	231 high school students, aged 15 to 17 years	Positive parenting actions, such as educating, nurturing, and guiding, among other characteristic traits of parenting styles, are associated with a lower prevalence of

					disruptive behaviors.
6	Campoverde & Ramos (2025)	To analyze disruptive behaviors in adolescents at a shelter in Guayaquil, Ecuador.	Descriptive, non-experimental design	40 participants, aged 14 to 18 years	The causes of disruptive behavior are linked to family and social factors, which contribute to the display of defiant, disobedient, and aggressive behavior, as well as difficulties in controlling emotions.
7	Escobar et al. (2025)	Identify disruptive behaviors exhibited by high school students	Cross-sectional, descriptive design	128 adolescents aged 12 to 17	Disruptive behaviors increase with student age, driven by factors such as the search for autonomy, social pressure, and emotional changes.
8	Basurto et al. (2021)	To identify whether family violence has significant academic and psychosocial repercussions that necessitate prevention through effective educational actions	It corresponds to a cross-sectional correlational study	A total of 75 adolescents were included	Age, gender, and manifestations of disruptive behavior in adolescents show no significant relationship with personal factors.

In table 1, according to scientific evidence, family violence shows an association with disruptive behaviors. That is, when adolescents are constantly exposed to violent acts, they are more likely to exhibit disruptive behaviors. Conversely, if the family is free from violence, it not only helps prevent disruptive behaviors but also creates an ideal environment for healthy coexistence (Becerra et al., 2025).

Furthermore, in families where communication is more open, roles become clear, affection is expressed, and there is greater cohesion—among other behaviors that reinforce a positive family dynamic—these factors will help reduce disruptive behaviors (Arnao et al., 2024; Luján et al., 2019).

Additionally, the parenting style adopted by parents serves as a preventive factor that helps manage disruptive behavior; in other words, when adolescents internalize household rules, disruptive behavior decreases not out of fear of punishment, but because of the conviction that following these rules is essential for harmonious coexistence (Barros et al. 2025; Rodríguez et al., 2025).

Another finding posits that disruptive behaviors result from failures in support systems; when family and social environments become unstable, adolescents perceive that household models fail to provide the necessary emotional support and mental peace (Campoverde y Ramos, 2025).

The increase in disruptive bintrafebehavior is also related to age; it stems from adolescents' own search for independence, social influences, and the maturation typical of this stage (Escobar et al., 2025). However, adolescent characteristics such as age and gender do not necessarily determine whether disruptive behavior will occur; rather, there are other external factors that influence these actions (Basurto et al., 2021).

3.2. Discussion

The review emphasizes that the family environment is not always a passive factor, rather, it is a mechanism for frequent changes in behaviors, family violence leads to disruptive behaviors, meaning that when adolescents live in violence, the home ceases to be a safe space, which leads to problematic behaviors. To manage rebellious behavior, the solution is not the absence of punishment, but rather strengthening the family's internal dynamics through communication, clear rules, emotional cohesion, and emotional support, among other actions that help prevent disruptive behaviors. The position of Tupullima et al. (2023) considers that violent households have a significant impact on emotional well-being and contribute to problematic behavior. Violence is a multifaceted phenomenon with deep-rooted causes within the social system (Quispelay et al., 2022). However, the parenting model within the home is a highly formative approach that operates within the family system; it is a supportive environment that ensures the protection and well-being of every family member and aims to minimize disruptive behavior in adolescents (Zambrano, 2021).

Family and social instability also contribute to adolescents experiencing emotional emptiness, which leads to disruptive behaviors; as a result, aggressive behavior or disobedience can become maladaptive responses. This finding is consistent with the study by Bordin et al. (2022) Frequent exposure to abuse within the family poses a significant risk to emotional well-being and can lead to the development of disruptive behaviors. However, when parents take on a more active role in caring for and consistently guiding their child, the home becomes a safe haven where violence is set aside; this positive family environment helps reduce rebellious behavior in adolescents. As indicated, Luján et al. (2019) Simply fostering friendly family relationships and showing respect for one another within the household is a mechanism that helps prevent the emergence of problematic behaviors.

Finally, as adolescents grow older, they seek greater autonomy and become more susceptible to social pressure—a process characteristic of adolescence, during which cognitive and emotional maturation play a decisive role in behavior. The fact is that gender and age do not always correlate with disruptive behavior; rather, external factors

are more decisive, that is, disruptive behavior is driven by social influences that go beyond chronological age. The family and social environment play a role in mitigating disruptive behavior, with dialogue serving as the primary tool for fostering conflict-free behavior, Sitota & Tefera (2024) They point out that family cohesion is essential, but it is also crucial to manage conflicts, provide parental supervision, and maintain good communication. Therefore, the various scientific findings analyzed suggest that exposure to violent family environments not only impairs adolescents' emotional and mental health but also serves as a precursor that directly influences disruptive behaviors. Consequently, it is necessary to understand the dynamics within the family system in order to develop strategies that contribute to a harmonious family life free from severe behavioral problems in adolescents.

IV. Conclusions

the review of articles indicates that adolescent behavior reflects the degree of integration within the family environment, as there is a link between family violence and disruptive behaviors. Meanwhile, communication patterns, affection, parenting styles, and family cohesion serve as protective factors against the emergence of risky behaviors. Furthermore, age and gender do not determine rebellious behavior; rather, it arises from a lack of emotional support.

Ethical Statement

The construction and finalization of this work was strictly guided by the editorial and methodological guidelines established by the 7th edition of the APA style guide. Furthermore, it is grounded in the principles of scientific integrity, which guarantees the originality of the content; it adheres rigorously to citation and referencing practices, avoiding plagiarism, which ensures academic transparency and honesty.

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Effect of Physical Activity on Academic Performance in Secondary School Students

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ABSTRACT

This article analyzes the influence of a physical activity program on students' academic performance through an experimental design with a control group. The study arises from the need to identify pedagogical strategies that contribute to improving academic performance from a comprehensive approach that considers cognitive, physical, and emotional aspects. The main objective was to determine the effect of physical activity on students' academic performance. To achieve this, a quantitative experimental methodology was used, with a pretest–posttest design and a control group. The sample consisted of 60 students, divided into an experimental group ($n = 30$) and a control group ($n = 30$). The experimental group participated in a structured physical activity program for eight weeks, with a frequency of three sessions per week, while the control group continued with their usual academic activities without intervention. The results showed a significant increase in the academic average of the experimental group (Difference = +2.7) compared to the control group (Difference = +0.3), demonstrating the positive effect of physical exercise on the learning process. Inferential analysis using the Z-test ($Z = 2.85$; $p < 0.05$) confirmed statistically significant differences between both groups.

It is concluded that physical activity positively influences academic performance by improving cognitive processes such as attention, memory, and concentration, as well as students' emotional well-being. These findings support the inclusion of physical activity programs in the educational environment.

Keywords: Academic performance, experiment, learning, physical activity, students

I. Introduction

Academic performance constitutes one of the main indicators of educational achievement, as it allows the assessment of the level of learning attained by students

(Donnelly et al., 2016). In this regard, academic performance is influenced by multiple factors, including cognitive, emotional, and physical variables (Singh et al., 2019). In recent years, physical activity has gained relevance as a determining factor in the comprehensive development of students (Álvarez-Bueno et al., 2017). According to Hillman et al. (2018), physical exercise enhances brain functioning by increasing blood flow and oxygenation, which positively impacts cognitive processes. Likewise, several studies have shown that physical activity improves cognitive functions such as memory, attention, and concentration (Chaddock et al., 2011; Diamond, 2015), and also demonstrates a positive relationship between physical fitness and academic performance in students (Esteban-Cornejo et al., 2015).

On the other hand, experimental studies indicate that students who participate in physical activity programs achieve better academic results compared to those who do not engage in exercise (Fedewa & Ahn, 2011). Similarly, Sibley and Etnier (2003) found a significant correlation between physical activity and cognitive performance in children and adolescents. Regarding mental health, physical activity has been shown to act as a protective factor against stress and anxiety (Biddle & Asare, 2011), contributing to psychological well-being, improving mood, and enhancing students' self-esteem (Lubans et al., 2016). Furthermore, regular physical activity promotes positive classroom behavior by increasing discipline and academic motivation (Donnelly et al., 2016), without negatively affecting academic performance, but rather enhancing it (Trudeau & Shephard, 2008).

From a neuroscientific perspective, physical exercise stimulates neurogenesis and brain plasticity, facilitating learning (Ratey & Loehr, 2011), as well as improving executive functions, which are essential for decision-making and problem-solving (Best, 2010). In this line, Carlson et al. (2008) found that students with higher levels of physical activity achieve better results in subjects such as mathematics and reading, while Rasberry et al. (2011) conclude that there is consistent evidence supporting the positive relationship between physical activity and academic performance. Likewise, physical fitness is directly related to academic performance in primary education students (Castelli et al., 2007), and physical activity positively influences classroom behavior and attention (Donnelly & Lambourne, 2011).

Additionally, longitudinal studies have shown that the effects of physical activity on academic performance can be maintained over time (Booth et al., 2014), even serving as a significant predictor of academic success (Haapala, 2013). At the international level, physical activity has been associated with improved academic outcomes across different educational contexts (García-Hermoso et al., 2021), and structured exercise programs have been shown to enhance academic performance in adolescents (Ardoy et al., 2014). However, despite the scientific evidence, physical activity is not prioritized in many educational systems (Tremblay et al., 2016), highlighting the need for educational policies that promote active lifestyles (Kohl & Cook, 2013). Furthermore, limitations still exist in experimental evidence to establish clear causal relationships

between physical activity and academic performance (Lees & Hopkins, 2013), emphasizing the need for more rigorous experimental research designs.

In this context, the present study aims to determine the effect of a physical activity program on academic performance in students through an experimental design with a control group.

II. Methodology

Research Type and Design

The study followed a quantitative approach with an experimental design at an explanatory level. A pretest–posttest design with an experimental group and a control group was employed to assess the effect of the intervention.

Participants

The population consisted of secondary school students, from which a sample of 60 participants was selected using simple random sampling. The participants were divided into two groups:

- Experimental group (n = 30)
- Control group (n = 30)

Variables

The independent variable was physical activity, operationalized through a structured exercise program conducted three times per week over eight weeks. The dependent variable was academic performance, measured through students' grade point averages.

Intervention

The experimental group participated in a structured physical activity program lasting eight weeks, with a frequency of three sessions per week.

Instruments

The instruments used included academic records, observation sheets, and questionnaires. The procedure involved administering a pretest to both groups, implementing the intervention in the experimental group, and subsequently applying a posttest.

Statistical Analysis

Data analysis was conducted using:

- Descriptive statistics

- Mean comparison
- Z-test for independent samples

3.1. Results and discussion

3.1. Results

The results show differences between the experimental group and the control group after the intervention.

In the initial assessment (pretest), both groups showed similar levels of academic performance, with the experimental group obtaining an average score of 13.5 and the control group 13.7, indicating homogeneity prior to the intervention. After the implementation of the physical activity program over eight weeks, the posttest results revealed a significant increase in the experimental group, which reached an average of 16.2, reflecting an improvement of +2.7 points, whereas the control group showed only a minimal change, increasing from 13.7 to 14.0 (+0.3). These findings indicate that students who participated in the physical activity program achieved greater academic progress compared to those who did not receive the intervention, demonstrating a significant improvement in the experimental group relative to the control group.

Table 1

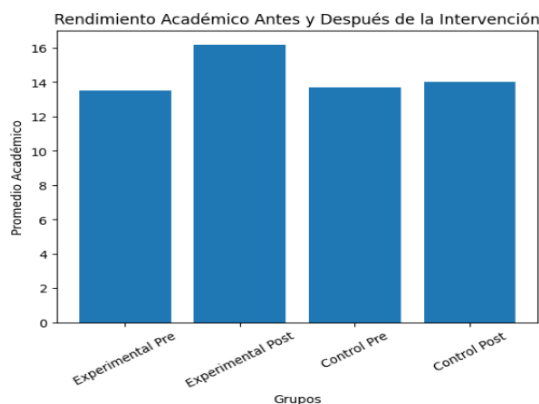
Academic Performance Comparison

Group	Pretest	Posttest	Difference
Experimental	13.5	16.2	2.7
Control	13.7	14.0	0.3

Note. Results obtained from the analysis of grades before and after the intervention.

Figure 1

Academic performance before and after the intervention.



Inferential Analysis (Z-test)

To determine whether the observed differences between the groups are statistically significant, a Z-test for comparison of independent means was applied.

The following hypotheses were formulated:

- H_0 : There are no significant differences in academic performance between the experimental group and the control group.
- H_1 : There are significant differences in academic performance between both groups.

Considering the posttest results:

- Mean of the experimental group (X_1) = 16.2
- Mean of the control group (X_2) = 14.0
- Mean difference = 2.2

Assuming a similar standard deviation in both groups and a sample size of $n = 30$ per group, an approximate value was obtained:

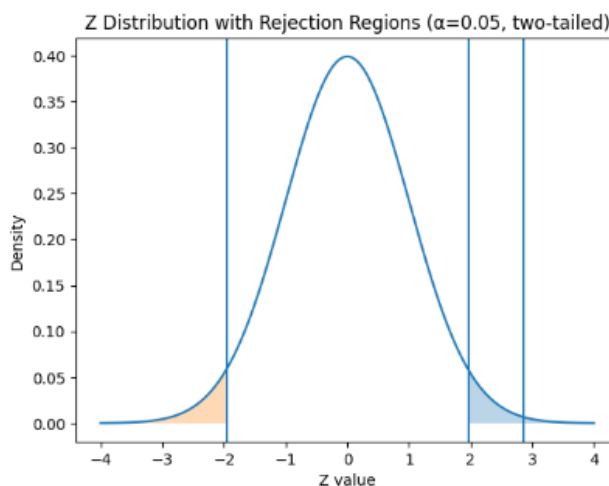
Z calculated = 2.85

The critical value for a significance level of $\alpha = 0.05$ (two-tailed) is:

Z critical = ± 1.96

Figure 2

Inferential analysis using the Z-test.



From the graph, we have:

$Z_{\text{calculated}} (2.85) > Z_{\text{critical}} (1.96)$

the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted.

Interpretation

The results indicate that there is a statistically significant difference between the experimental group and the control group in the posttest, confirming that the physical activity program had a positive effect on students' academic performance. Furthermore, the magnitude of the observed difference suggests that the intervention is not only statistically significant but also relevant from an educational perspective.

3.2. Discussion

The results of the present study confirm that the implementation of a structured physical activity program produces significant improvements in students' academic performance, which is consistent with the findings reported by Donnelly et al. (2016), who indicate that physical activity positively impacts school performance through improvements in cognitive function and classroom behavior. Similarly, Hillman et al. (2018) argue that exercise enhances neuroplasticity and brain efficiency, leading to better performance in processes such as attention, memory, and concentration, which helps explain the improvement observed in the experimental group. Furthermore, the findings are consistent with the meta-analysis by Álvarez-Bueno et al. (2017), who identified a positive relationship between physical activity and academic performance, although they note that the effect size is generally moderate; however, in this study, the observed effect is greater, possibly due to the experimental and controlled nature of the intervention. Likewise, Fedewa and Ahn (2011) highlight that structured physical activity programs produce more significant impacts than unstructured activity, which reinforces the validity of the results obtained. Nevertheless, in line with Lees and Hopkins (2013), it is acknowledged that there are limitations related to sample size and intervention duration, which may restrict the generalizability of the findings; therefore, further longitudinal studies with larger samples are recommended to strengthen the evidence regarding the causal relationship between physical activity and academic performance.

IV. Conclusions

It is concluded that the implementation of a physical activity program has a positive and statistically significant influence on students' academic performance, as evidenced by the improvement in the average score of the experimental group compared to the control group. The inferential analysis using the Z-test for independent means ($Z = 2.85$; $p < 0.05$) allowed the rejection of the null hypothesis and confirmed the existence of significant differences between both groups, demonstrating that the observed effect is not due to chance but to the applied intervention. In this sense, physical activity

contributes to the strengthening of cognitive processes such as attention, memory, and concentration, as well as improving motivation and readiness for learning, establishing itself as an effective strategy to optimize academic performance in secondary school students.

Ethical Statement.

The research was conducted in accordance with ethical principles, ensuring the confidentiality of the participants and the responsible use of information. Likewise, informed consent was obtained from the students.

Acknowledgment

The authors would like to thank the PERU BIRF Educational Institution of Azángaro – Puno for providing the necessary support for the implementation of the study, as well as the participating students for their valuable collaboration, commitment, and willingness throughout the development of the physical activity program. Likewise, appreciation is extended to the teachers and academic authorities who contributed to the coordination and monitoring of the activities carried out. In addition, gratitude is expressed to all individuals who, directly or indirectly, made the execution of this research possible, contributing to the achievement of the proposed objectives.

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Relationship Between Emotional Attention and Academic Performance in Social Sciences Among Fourth-grade Secondary Students at San José School in Puno, 2023

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ABSTRAC

The present study was conducted in the context of the San José Secondary Educational Institution in Puno, considering the relevance of emotional competencies in students' learning processes. The objective of the research was to identify the relationship between attention to emotions and academic performance in the area of Social Sciences among fourth-grade students during the year 2023. The research was framed within a quantitative approach, basic type, with a non-experimental, correlational, and cross-sectional design. The population consisted of 15 students, to whom the TMMS-24 questionnaire was applied, specifically considering the emotional attention dimension. Academic performance was obtained through the review of official grades. The descriptive results showed that 50.00% of the students presented a medium level of emotional attention, with 35.71% standing out at an outstanding achievement level. Likewise, 28.57% showed a high level of emotional attention, while 21.43% presented a low level, concentrated in the process and initial levels. In the inferential analysis, a Pearson correlation coefficient of $r = 0.890$ and a significance level of $p = 0.000$ ($p < 0.01$) were obtained, indicating a very strong and statistically significant positive relationship between the variables. It is concluded that attention to emotions significantly influences academic performance; therefore, it is recommended to strengthen emotional skills to improve school performance.

Keywords: Academic performance, Emotional intelligence, Secondary education, Students, social sciences.

I. Introduction

Emotional intelligence has been widely studied as a determining factor in the comprehensive development of students. In this regard, it is argued that the ability to recognize and manage emotions directly influences

learning (Goleman, 1995). Likewise, Mayer and Salovey (1997) define emotional intelligence as the ability to perceive, understand, and regulate emotions. On the other hand, various studies show that students with greater emotional control achieve better academic results (Fernández & Extremera, 2005). Consequently, modern education incorporates emotional development as a transversal axis (Bisquerra, 2000). Similarly, emotional regulation has been shown to contribute to school adaptation (Pekrun, 2006). In this line, emotional intelligence is linked to motivation and academic achievement (Bar-On, 2006).

Regarding the dimensions of emotional intelligence, emotional attention allows students to identify their affective states (Salovey et al., 1995). In turn, emotional clarity facilitates the understanding of these states (Extremera & Fernández-Berrocal, 2006). Furthermore, emotional repair refers to the ability to regulate negative emotions (Gross, 2002). Various authors agree that these dimensions influence academic performance (Brackett et al., 2011). In this sense, students with greater emotional clarity demonstrate better learning strategies (Schutte et al., 2002). Likewise, emotional self-regulation promotes decision-making in educational contexts (Zimmerman, 2000). Therefore, the development of these skills is essential in school education (Parker et al., 2004).

With respect to academic performance, it is understood as the level of achievement reached by students in their educational process (Bloom, 1976). Within this framework, multiple studies show its relationship with emotional factors (Valiente et al., 2007). Similarly, performance depends not only on cognitive abilities but also on socio-emotional variables (Duckworth & Seligman, 2005). On the other hand, it has been found that motivation and emotional management influence academic success (Pintrich, 2000). Likewise, students with higher emotional intelligence experience lower academic anxiety (Cassady & Johnson, 2002). Consequently, academic performance is strengthened by emotional competencies (Elias et al., 1997).

Regarding the relationship between both variables, various studies have found significant correlations between emotional intelligence and academic performance (Petrides et al., 2004). In this sense, it has been shown that emotionally competent students achieve better results (Qualter et al., 2012). Similarly, emotional intelligence acts as a predictor of academic success (MacCann et al., 2020). On the other hand, research in Latin American contexts confirms this relationship (Sánchez et al., 2017; Gindaba et al., 2016). Likewise, Linhart and Grant (2016) point out that individual differences influence academic performance. Consequently, emotional intelligence is consolidated as a key factor in learning (Lusk & Del Pozo, 2018).

Finally, the results of the research show a positive and significant relationship between emotional intelligence and academic performance. In this regard, it is confirmed that the development of emotional skills enhances learning (Bisquerra, 2009). Likewise, students with greater emotional control achieve better grades (Extremera & Fernández-Berrocal, 2001). On the other hand, emotional education contributes to the

comprehensive formation of students (Delors, 1996). In addition, emotional intelligence has been shown to reduce academic stress (Zeidner et al., 2012). Consequently, promoting these competencies in the classroom is essential (CASEL, 2013). Therefore, emotional intelligence should be considered an essential component in modern education.

II. Methodology

The research was conducted under a quantitative approach, as numerical data were collected and analyzed in order to identify the relationship between attention to emotions and academic performance in the area of Social Sciences. The type of research was basic, aimed at generating theoretical knowledge about the relationship between these variables.

The design was non-experimental, correlational, and cross-sectional, since the study variables were not manipulated and data collection was carried out at a single point in time.

The population consisted of 15 fourth-grade secondary school students from San José Secondary Educational Institution in Puno, who also constituted the sample, as the entire population was considered.

For data collection, the TMMS-24 questionnaire was used, specifically focusing on the emotional attention dimension as the independent variable. Academic performance, as the dependent variable, was obtained through documentary review of the official evaluation records in the Social Sciences area.

Data processing and analysis were carried out at two levels: descriptive and inferential. At the descriptive level, the data were organized into double-entry tables, allowing the identification of the percentage distribution of students according to levels of attention to emotions (high, medium, and low) and levels of academic performance (outstanding achievement, expected achievement, in process, and initial). At the inferential level, Pearson's correlation coefficient was applied to determine the degree of relationship between the study variables.

III. Results and discussion

3.1. Results

The results obtained show the existence of a positive relationship between attention to emotions and academic performance in the area of Social Sciences among fourth-grade students at San José Secondary Educational Institution in Puno, 2023.

Table 1 presents the percentage distribution of students according to levels of attention to emotions and academic performance. It is observed that 50.00% of the students present a medium level of emotional attention, of which 35.71% reach the outstanding

achievement level. Likewise, 28.57% of the students are at a high level of emotional attention, mainly standing out at the expected achievement level (7.14%) and, to a lesser extent, at the initial level (21.43%). On the other hand, 21.43% present a low level of emotional attention, concentrated in the process (14.29%) and initial (7.14%) levels.

According to the inferential statistical analysis carried out using Pearson's correlation coefficient (see Table 1 and Figure 1), a value of $r = 0.890$ was obtained with a significance level of $p = 0.000$ ($p < 0.01$), indicating that the relationship is positive, very strong, and statistically significant.

These results allow us to affirm that students with higher levels of attention to their emotions tend to achieve better academic results. Likewise, the trend observed in Figure 1 shows an upward pattern, visually confirming the direct relationship between both variables. Consequently, it is evident that attention to emotions significantly influences students' academic performance.

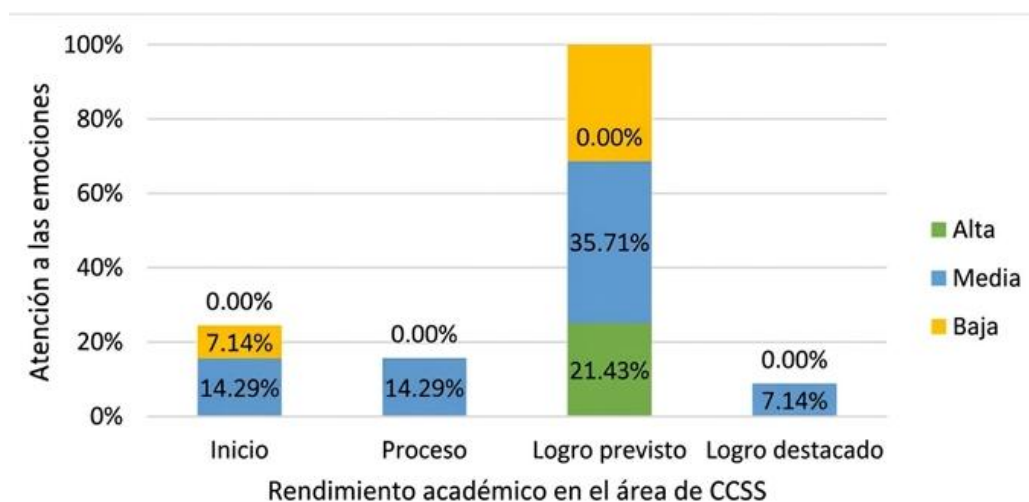
Table 1

Relationship between emotional attention and academic performance in Social Sciences among fourth-grade secondary students at San José School in Puno, 2023.

Attention to emotions	Outstanding achievement	Expected achievement	In progress	Initial	Total
High	0.00%	7.14%	0.00%	21.43%	28.57%
Medium	35.71%	0.00%	0.00%	14.29%	50.00%
Low	0.00%	0.00%	14.29%	7.14%	21.43%
Total	35.71%	7.14%	14.29%	42.86%	100.00%

The table shows the percentage distribution of students according to their levels of attention to emotions and their academic performance in the area of Social Sciences. It is observed that the highest proportion of students with a medium level of emotional attention achieve outstanding results, while low levels are associated with the in-process and initial stages.

Figure 1



Shows that 35.71% of students demonstrate a medium level of attention to emotions and an academic performance in the area of Social Sciences at the expected achievement level; additionally, 21.43% of students show a high level of attention to emotions and an academic performance at the expected achievement level; on the other hand, 14.29% of students present a medium level of attention to emotions and an academic performance at the in-process level.

3.2. Discussion

The results of this study demonstrate the existence of a very strong, positive, and statistically significant relationship between emotional attention and academic performance in Social Sciences ($r = 0.890$; $p < 0.01$). This finding directly responds to the research objective derived from the title and is consistent with the theoretical approaches of emotional intelligence proposed by Goleman (1995), who emphasizes that emotional competencies are fundamental in academic success. Similarly, Mayer and Salovey (1997) argue that the ability to perceive and attend to emotions constitutes a key process that influences cognitive functioning and learning.

From a comparative perspective, the findings are aligned with previous empirical studies that identify emotional intelligence as a predictor of academic performance (MacCann et al., 2020; Petrides et al., 2004). In the same vein, Fernández-Berrocal and Extremera (2005) affirm that students with higher emotional competencies tend to achieve better academic outcomes, which is consistent with the trend observed in this study, where medium and high levels of emotional attention are associated with higher levels of achievement. Furthermore, the results support the theoretical contributions of

Pekrun (2006), whose control-value theory explains that emotional processes influence academic engagement and performance.

Likewise, the descriptive findings showing that students with higher emotional attention tend to reach outstanding achievement levels are consistent with the contributions of Bisquerra (2000), who highlights the importance of emotional education in improving academic performance. In addition, these results can be interpreted through the lens of self-regulated learning theory (Zimmerman, 2000), which suggests that emotional awareness facilitates better control over learning processes, thereby enhancing academic outcomes.

However, from a critical standpoint, the magnitude of the correlation ($r = 0.890$) suggests an exceptionally strong relationship, which may lead to an overestimation of the role of emotional attention as a determining factor of academic performance. As pointed out by Duckworth and Seligman (2005), academic achievement is a multidimensional construct influenced not only by emotional variables but also by cognitive abilities, motivation, and contextual factors. Therefore, attributing such a high level of influence solely to emotional attention may oversimplify the complexity of the phenomenon.

Moreover, an important inconsistency was identified in the results, as a group of students with high emotional attention were located at lower levels of academic performance. This finding challenges the assumption of a linear relationship and supports the perspective of Salovey et al. (1995), who argue that emotional intelligence is composed of multiple dimensions. In this sense, the absence of emotional clarity and emotional regulation (Gross, 2002) may limit the positive effects of emotional attention, or even generate negative outcomes such as emotional overload or rumination.

Additionally, the non-experimental and cross-sectional design of the study limits the possibility of establishing causal relationships. As suggested by Linhart and Grant (2016), individual differences and contextual variables may significantly influence academic performance. Therefore, although the correlation is statistically significant, it does not imply causality. Future research should incorporate longitudinal and experimental designs to better understand the directionality of this relationship.

In synthesis, the findings confirm the theoretical and empirical relationship between emotional attention and academic performance, reinforcing the importance of emotional competencies in the educational context. However, a critical analysis reveals that emotional attention should not be considered an isolated factor, but rather part of a broader system of emotional and cognitive variables that interact in complex ways to influence academic achievement.

IV. Conclusions

The study confirmed the existence of a very strong, positive, and statistically significant relationship between attention to emotions and academic performance in the area of Social Sciences among fourth-grade students at San José Secondary Educational Institution in Puno in 2023, supported by a Pearson correlation coefficient of $r = 0.890$ and a significance level of $p < 0.01$.

Furthermore, the descriptive findings revealed that students with medium and high levels of emotional attention tend to achieve higher levels of academic performance, predominantly at the outstanding achievement level. In contrast, students with low levels of emotional attention are mainly associated with in-process and initial achievement levels, reflecting lower academic performance.

Therefore, it can be concluded that attention to emotions plays a significant role in academic performance, as it facilitates the recognition of emotional states and supports the learning process. In this regard, the implementation of emotional education programs is recommended in order to strengthen students' emotional skills, improve their well-being, and enhance their academic performance.

Ethical Statement

This research complies with the necessary ethical requirements throughout the entire research process. It adheres to the principles of transparency and respect for the rights of all participants involved in the study.

Acknowledgment

I would like to express my sincere gratitude to all those who contributed to the successful completion of this research. First, I extend my deepest appreciation to my advisor for their guidance, support, and valuable recommendations throughout the development of this study.

Finally, I would like to thank my family for their constant support, encouragement, and understanding, which motivated me to achieve this goal.

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Urban Music in the Personality Formation of Students at the Pedro Vilcapaza Secondary Educational Institution in Juliaca, 2023

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ABSTRACT

In the context of cultural globalization, urban music (rap, reggaeton, and hip hop) has become a significant influence in the daily lives of Peruvian adolescents, particularly in highland regions such as Puno, where it coexists with deep-rooted Andean traditions. The main objective was to determine the influence of urban music on the personality formation of 65 fourth-grade students at the Pedro Vilcapaza Secondary Educational Institution (Juliaca, 2023). A non-experimental cross-sectional design was employed, with structured observation conducted through a validated 5-point Likert-scale guide (Cronbach's Alpha > 0.7). Data analysis was performed using SPSS version 25, employing descriptive statistics (frequencies and percentages) and inferential statistics (Spearman's Rho correlation). The results showed predominantly mild to moderate intensities in exposure indicators (for example, 38.5% mild intensity in freedom of expression with rap) and statistically significant positive correlations between urban music exposure and personality dimensions: general personality ($\rho = 0.832$, $p = 0.003$), extraversion ($\rho = 0.693$, $p = 0.002$), openness ($\rho = 0.478$, $p = 0.001$), and responsibility ($\rho = 0.728$, $p = 0.048$). The study determined that urban music exerts a significant influence on the personality formation of students at the Pedro Vilcapaza Secondary Educational Institution (Juliaca, 2023). It is recommended to implement educational strategies that promote reflective and balanced consumption of this music.

Keywords: Extraversion, openness, personality, responsibility, urban music.

I. Introduction

Urban music, encompassing genres such as rap, reggaeton, and hip hop, has emerged as one of the most influential cultural expressions among contemporary adolescents worldwide. In Peru, this phenomenon acquires special relevance in highland cities like Juliaca, where global urban rhythms interact daily with traditional Andean cultural practices. This constant interaction creates a unique sociocultural dynamic that subtly

shapes young people's sense of identity, emotional expression, and personality development (Aimacaña, 2014; Coaquira, 2019; Malavé, 2022).

Several authors have explored this complex interaction from different angles. Aimacaña (2014) highlights the creative tensions generated by cultural globalization in rap, viewing it as a space for collective imagination and resistance. Similarly, Coaquira (2019) and Malavé (2022, 2023) document the exciting, yet potentially disruptive effects of reggaeton on adolescent behavior, including heightened emotional intensity, changes in social patterns, and shifts in value systems. Complementary international and Latin American studies suggest that prolonged exposure to these genres can stimulate creativity and sociability on one hand, while simultaneously encouraging risk behaviors such as aggression, early sexualization, or disregard for authority on the other (Ito, 2019; Sialer, 2019; Wingood et al., 2003; Marín, 2023; Faure Carvallo, 2020).

In the educational sphere, some researchers advocate for the pedagogical integration of urban music as a tool to develop critical thinking, creative expression, and emotional awareness (Egea et al., 2017; Peñalba, 2018). However, a considerable number of studies raise important concerns regarding the frequent presence of sexist, violent, or machista content in the lyrics, which may reinforce negative gender stereotypes and antisocial attitudes among young listeners (Moreno, 2021; Noriega, 2014; Casanovas-Buliart, 2024; Gorgoritos, 2023).

From a psychological perspective, core personality traits — such as extraversion, openness to experience, and responsibility — are not formed in isolation but are continuously influenced by external stimuli, including the rhythms, lyrics, and cultural messages embedded in music (Filloux, 1992; Chicoma Arellano, 2022). In Peru's culturally diverse settings, urban music frequently enters into dialogue — and sometimes conflict — with local Andean traditions, potentially affecting not only academic performance but also classroom coexistence, emotional regulation, and long-term identity construction (Soto, 2017; Cueto, 2006; Martínez, 2007; Andreu, 2024).

Although the body of Latin American research on urban music and youth has grown considerably in recent years (Malavé, 2023; Guepud-Guapaz, 2025; Moreno Cazalla, 2023; Zavaleta Espinoza, 2020), important empirical gaps remain in highland regions such as Puno. Most existing studies have concentrated on coastal urban settings or have limited themselves to lyrical content analysis, leaving limited evidence on how urban music influences personality formation among secondary school students in Andean cultural contexts (Jarita, s.f.; Platt, 2018; Torres Ruiz, 2024).

The present study seeks to address this gap by examining, through structured classroom observation of 65 fourth-grade students during 2023, the relationship between exposure to urban music and key personality dimensions (extraversion, openness to experience, and responsibility). The preliminary findings reveal an ambivalent influence: urban music appears to strengthen expressive and social capacities on one hand, while on the

other it may contribute to rebellious attitudes or a diminished sense of responsibility. Understanding this complex interplay is essential for the development of culturally sensitive and inclusive educational strategies capable of harnessing the positive potential of urban music while mitigating its possible negative effects in contemporary Peru (Andreu, 2024; Marín, 2023; Montoya Canchis, 2023).

II. Methodology

The study adopted a quantitative approach to objectively measure the relationships between variables. It followed a descriptive-correlational design that described the intensity of exposure to urban music and explored its associations with personality dimensions, without any experimental manipulation. A non-experimental cross-sectional design was used, with all data collected during the 2023 academic year. The target population consisted of 1,688 secondary students at the Pedro Vilcapaza Secondary Educational Institution. Due to practical constraints and direct access to the classroom environment, a non-probabilistic convenience sample of 65 fourth-grade students (sections A and C) was selected.

Structured observation was carried out in natural classroom settings using a 5-point Likert-scale observation guide that was previously validated by experts in music education and psychology and showed acceptable internal consistency (Cronbach's Alpha > 0.7). The independent variable was exposure to urban music, with specific indicators according to genre, while the dependent variable was personality, assessed through observable indicators of extraversion, openness to experience, and responsibility. Ethical procedures involved instrument validation, institutional authorization, and informed consent. Observation was conducted discreetly on October 26, 2023. Data were analyzed using SPSS version 25, combining descriptive statistics (frequencies and percentages) with inferential statistics (Spearman's Rho correlation, with statistical significance set at $p \leq 0.05$).

III. Results and discussions

3.1. Results

The findings were described following the order of the research objectives. Descriptive analysis was used for the intensities of urban music exposure (rap, reggaeton, and hip hop), and inferential analysis was used for the correlations with personality dimensions (extraversion, openness, and responsibility). Data were collected from 65 fourth-grade students at the IES Pedro Vilcapaza in 2023.

Table 1

Intensity in the Rap Dimension: Exercise of Freedom of Expression (N=65)

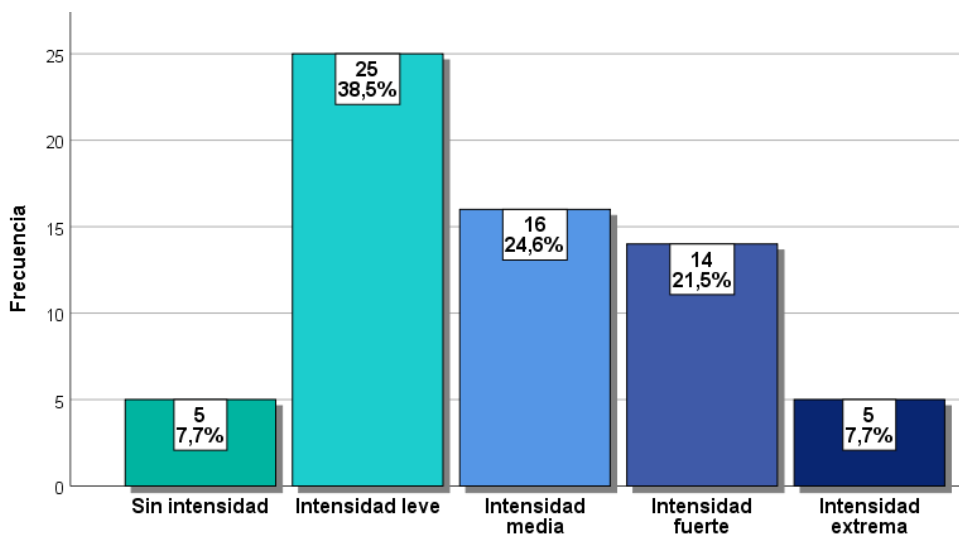
Level of intensity	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
No intensity	5	7.7	7.7	7.7
Mild	25	38.5	38.5	46.2
Medium	16	24.6	24.6	70.8
Strong	14	21.5	21.5	92.3
Extreme	5	7.7	7.7	100.0
Total	65	100.0	100.0	-

Mild intensity predominates (38.5%), suggesting a moderate influence on verbal expression.

(Analogous interpretations apply to Tables 2 and 3: improvisation for rhyming shows a predominance of medium intensity at 32.3%; social problems show a predominance of mild intensity at 33.8%.)

Figure 1

Distribution of intensity in freedom of expression (Rap).



Note. Bar chart generated from Table 1. (Analogous interpretations apply to Tables 2 and 3: improvisation for rhyming shows a predominance of medium intensity at 32.3%; social problems show a predominance of mild intensity at 33.8%.)

Table 2

Intensity in the Rap Dimension: Improvisation for Rhyming (N=65)

Level of intensity	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
No intensity	7	10.8	10.8	10.8
Mild	18	27.7	27.7	38.5
Medium	21	32.3	32.3	70.8
Strong	17	26.2	26.2	96.9
Extreme	2	3.1	3.1	100.0
Total	65	100.0	100.0	-

Figure 2

Distribution of intensity in improvisation for rhyming (Rap). Note. Medium intensity predominates (32.3%).

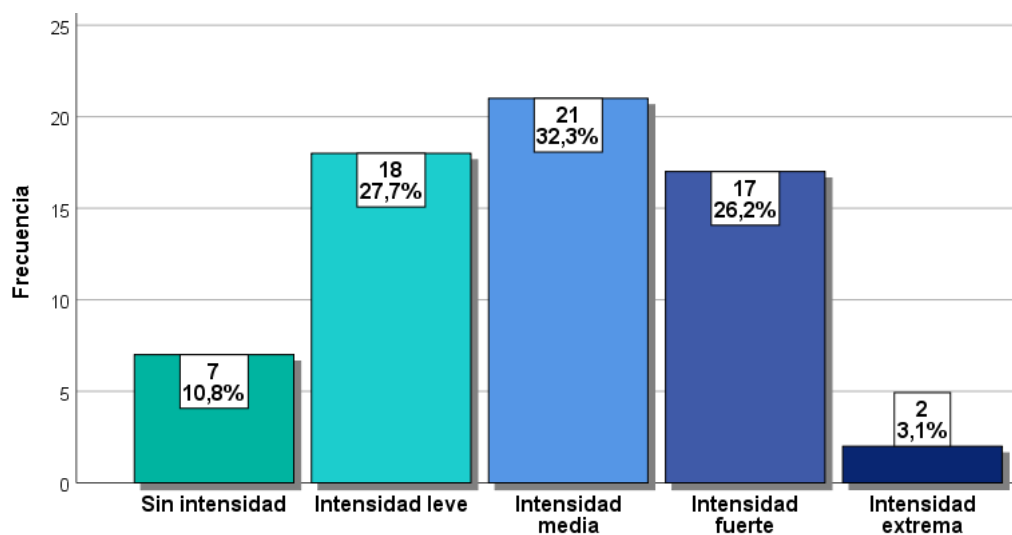


Table 3

Intensity in the Rap Dimension: Social Problems (N=65)

Level of intensity	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
No intensity	7	10.8	10.8	10.8
Mild	22	33.8	33.8	44.6
Medium	20	30.8	30.8	75.4
Strong	13	20.0	20.0	95.4
Extreme	3	4.6	4.6	100.0
Total	65	100.0	100.0	-

Figure 3

Distribution of intensity in social problems (Rap). Note. Mild intensity predominates (33.8%).

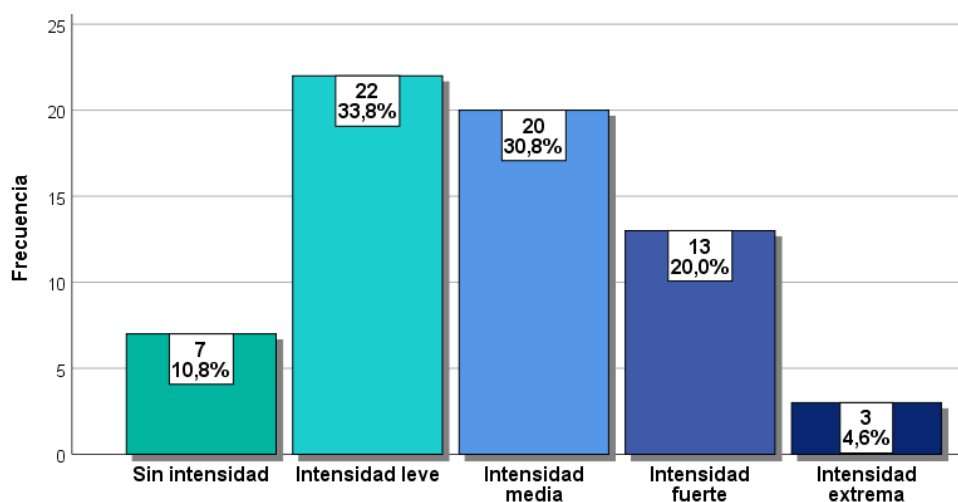


Table 4

Personality dimension	ρ (Coefficient)	p-value	Interpretation
General personality	0.832	0.003	Moderate positive
Extraversion	0.693	0.002	Moderate positive
Openness	0.478	0.001	Weak to moderate positive
Responsibility	0.728	0.048	Moderate positive

Spearman's Rho Correlations Between Urban Music and Personality Dimensions (N=65)

3.2. Discussion

The results reveal statistically significant positive correlations between urban music exposure and personality dimensions, aligning with previous studies (Malavé, 2022; Coaquira, 2019; Marín, 2023; Chicoma Arellano, 2022; Sialer, 2019; Moreno, 2021; Ito, 2019).

Urban music exerts an ambivalent influence: it enhances positive aspects such as sociability and extraverted energy (extraversion $\rho = 0.693$) and creativity (openness $\rho = 0.478$), while it may also be associated with rebellious tendencies and lower adherence to traditional responsibility (responsibility $\rho = 0.728$). These findings are consistent with the contradictory effects documented by Sialer (2019), Moreno (2021), and Ito (2019).

In the specific sociocultural context of Juliaca, where global urban rhythms coexist with deep-rooted Andean traditions, this influence functions as a double-edged sword (Andreu, 2024; Torres Ruiz, 2024; Platt, 2018). The primary contribution of this study is the provision of quantitative local evidence for the Puno highland region, addressing an important empirical gap identified in the literature (Jarita, s.f.; Guepud-Guapaz, 2025; Montoya Canchis, 2023).

Limitations of the study include the use of convenience sampling and its exclusively quantitative approach. Future research could benefit from mixed-methods or longitudinal designs to further explore these dynamics (Guepud-Guapaz, 2025; Montoya Canchis, 2023). The implementation of critical lyric analysis workshops is recommended to maximize the positive effects and mitigate potential risks of urban music consumption.

IV. Conclusions

The study determined that urban music exerts a significant influence on the personality formation of students at the Pedro Vilcapaza Secondary Educational Institution (Juliaca, 2023), with moderate correlations in extraversion, openness, and responsibility. This influence is ambivalent: it appears to enhance sociability and creativity, although it is also associated with risks such as rebellion or irresponsibility.

The findings highlight the need for reflective educational guidance in mixed cultural contexts in Peru.

Ethics Statement

The research complied with ethical principles of transparency, respect for participants, and confidentiality, adhering to institutional regulations without causing harm. Ethical procedures involved instrument validation, institutional authorization, and informed consent.

Conflict of interest statement

The author declares no conflicts of interest related to this study.

Acknowledgment

To my mother for her patience and constant support. To my teachers for their invaluable formative guidance. To the advisor and jury for their rigorous and valuable evaluation.

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Factors that influence attention deficit and hyperactivity in children of the third cycle of the Primary Educational Institution No. 70047 Huáscar of Puno – 2019

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ABSTRACT

Attention Deficit Hyperactivity Disorder (ADHD) is a disorder that does not allow for adequate and effective learning; therefore, this problem is relevant because it hinders the learning of the child. The research aimed to determine the factors that influence the development of Attention Deficit Hyperactivity Disorder (ADHD) in children in the third cycle of Primary Educational Institution No. 70047 Huáscar de Puno – 2019. The research is non-experimental and its design is causal-explanatory. The sample consists of 25 children from the first and second grades, aged between 6 and 8 years old. The observation technique was applied using an observation sheet (based on the criteria of the American Psychiatric Association) to identify ADHD in the children. A survey was also conducted using a questionnaire with 10 questions to determine the associated factors that influence ADHD. This was applied to the mothers of the children identified as part of the sample. Results were obtained from the seven mothers surveyed; 57.1% indicated that they or their child's father suffered from attention deficit hyperactivity disorder. Also, 57.1% reported that their child had suffered a head injury, suggesting that they may have inherited this attention problem genetically. On the other hand, 42.9% of the remaining mothers indicated that the indicators of the causal factors have not been present. It can be concluded that these two factors contribute to the development of the disorder, additionally, in a small percentage, alcohol consumption, the mother's poor health, and medication use during pregnancy by mothers indicated that these factors were present in their children who have ADHD.

Keywords: Attention deficit, genetic factor, neurobiological factor, hyperactivity.

I. Introduction

It is essential that children develop skills and acquire meaningful learning experiences, which are crucial for their personal and holistic development and their integration into

groups. However, a problem frequently arises during school age: attention deficit hyperactivity disorder (Conejeros, et al., 2018). According to the literature, this disorder hinders adequate and effective learning. Therefore, this problem is significant because it impedes children's learning. Consequently, it is important for classroom teachers to understand this disorder in order to work effectively with these children and prevent them from failing in their learning. (Bazan, 2013).

According to Marco, Grau, & Presentación (2011), ADHD spans the lifespan and is characterized by a greater presence of hyperactive and impulsive behaviors in the early years of life, while in adolescence or adulthood, the most prominent manifestations are inattention and behavioral disorganization.

Velasquez & Ordoñez (2015) state that mental health specialists indicate that Attention Deficit Hyperactivity Disorder (ADHD) is a highly prevalent disorder, estimated to affect between 9% and 17% of the child and adolescent population, and is three times more frequent in males. "This disorder is recognized for its chronic nature, as it persists and manifests beyond adolescence. Long-term follow-up studies have shown that between 60% and 75% of children with ADHD continue to exhibit symptoms into adulthood." (Pérez & Gardey, 2012).

Furthermore, Torres (2011) maintains that ADHD is a neurological disorder with implications for cognitive, emotional, and behavioral development, as well as personal, social, community, and academic spheres. The academic sphere is a particularly important area of concern due to the significant difficulties that arise at this level, such as poor academic performance and disinterest in classes. Therefore, this problem arose because it interested me more than other problems that were identified.

One problem observed in the school is the constant inattention and hyperactivity in some first and second grade elementary school children. This is why this research emerged, after observing, during my teaching practice, the constant inattention in some second grade children at the I.E.P. No. 71013 Glorioso "San Carlos" in the city of Puno, and also after observing signs of hyperactivity in some fourth grade children at the I.E.P. Collana I in Paucarcolla. All these children were easily distracted in the classroom, bothered their classmates, and moved around constantly. For this reason, we formulated the question at the Huáscar Institution.

Prior to this research, we have the study by Martinhago, Lavagnino, Folguera, & Caponi (2019), in their scientific article: "Risk Factors and Genetic Bases: The Case of Attention Deficit Hyperactivity Disorder," which aimed to critically analyze the validity of studies associated with the search for genetic markers for ADHD. They reached the following conclusion: The interest shown in recent years in describing the biological basis of ADHD can be framed within its use for diagnostic purposes and also as risk markers for the disorder. It has also been established that research on the

biological basis of ADHD, particularly genetic and genomic research, presents some shortcomings.

Meanwhile, Rivera (2013), in his research, "Etiology of Attention Deficit Hyperactivity Disorder and Associated Characteristics in Infancy and Childhood," whose objective was to determine the etiology of ADHD and the characteristics associated with the disorder that manifest in infancy and childhood, reached the following conclusion: The disorder is hereditary, and there are also risk factors during pregnancy and birth. The characteristics of ADHD in infancy and childhood are as follows: above-average activity levels, restlessness during sleep, persistent requests, normal gross motor development, poor fine motor coordination, a tendency to have accidents, slightly precocious language development, average academic progress, grade repetition, participation in special education programs, difficulty maintaining friendships, and poorly rule-governed behavior.

According to Mamani Pilco (2016), the general objective of her thesis was to evaluate the level of knowledge about Attention Deficit Hyperactivity Disorder (ADHD) among teachers and parents in private educational institutions in the city of Juliaca in 2016. The thesis concluded that the level of knowledge about ADHD among teachers in private educational institutions in the city of Juliaca in 2016, as determined by the survey, showed that 41% of teachers had a MEDIUM level of correct answers, indicating limited knowledge about ADHD.

According to Quispe (2004), in his thesis whose general objective was to determine the relationship between Attention Deficit Hyperactivity Disorder (ADHD) and family functioning in sixth-grade students at the "María Auxiliadora" and 70001 schools in Puno, the general conclusion was that the frequency of ADHD in sixth-grade students at the "María Auxiliadora" and 70001 schools in Puno, from March to June 2004, was 12.5%, using the DSM-IV diagnostic criteria.

According to Galicia (2019), in his second specialization thesis whose general objective was to determine the relationship between attention deficit and meaningful learning in five-year-old children at the IEI (Early Childhood Education Institute). Integrated 38633 Mantaro Cusco 2018. This thesis reached the following conclusion: A clear relationship exists between attention deficit and meaningful learning, and many 5-year-old children at this IEI have a high level of hyperactivity, which represents children with different types of problems in terms of retention, assimilation, and behavior.

II. Methodology

For data collection, the observation technique was used to identify children in the third cycle of the "Huáscar" Primary Educational Institution who exhibit Attention Deficit Hyperactivity Disorder (ADHD), using an observation checklist. Following Hernández

et al. (2014), the observation sheet corresponds to the observation technique. The sheet was used for approximately four weeks, starting each day from 9:00 a.m. to 12:00 p.m.

The survey technique was used to determine the factors that influence the development of ADHD, through a questionnaire with 10 questions administered primarily to mothers, in a confidential manner. The survey was conducted individually with each mother and lasted approximately 8 minutes per session.

The observation checklist used is based on the observation guide by Mamani Vilca (2017) and the diagnostic criteria proposed by the American Psychiatric Association (2013). The observation form was validated by psychologist Maynard R. Calizaya Palazuelos, Dr. Roberto A. Quenta Paniagua, and psychologist Ricardo Neyra Menéndez.

According to Tamayo (2003), the population is the entirety of a phenomenon under study; it includes all the units of analysis or population entities that comprise said phenomenon and that must be quantified for a given study. Accordingly, the population consisted of 35 first- and second-grade students from the Huascar Primary School in the city of Puno. The sample comprised 25 students from the study population. Following Otzen & Manterola (2017), purposive sampling (non-probability sampling) was used to determine the sample. This method is characterized by obtaining "representative" samples through the inclusion of supposedly typical groups.

Following Juste (2009), the chi-square (χ^2) statistical test was used to evaluate the hypothesis regarding the causal influence between the two variables (associated factors and ADHD). In general, the chi-square test is similar for both two and samples, and its formula is as follows:

χ^2 = calculated chi-square value.

θ_i = observed value.

E_i = expected value.

Σ = summation.

III. Results and discussion

3.1. Results

To verify the fulfillment of the objectives set forth in this research, the results were obtained using the statistical software SPSS version 23 and Excel 2013. These programs allowed for the processing of the statistical tables and graphs, the results of which are shown below:

3.1.1. Results in accordance with the general objective.

To establish the factors that influence the development of ADHD, 10 questions were included in the survey for mothers. These questions are based on the documentary analysis conducted on the factors that can cause ADHD.

Table 1

Survey Results Regarding the Causal Factors that Influence the Development of ADHD.

Causal Factors	Frequency				Total, Mothers Surveyed
	YES	%	NO	%	
Genetic contribution (History of Attention Deficit Hyperactivity Disorder)	4	57.1%	3	42.9%	7
Brain functional Impairment (Head Injury)	4	57.1%	3	42.9%	7

Note: Questionnaire for parents.

Intervals for the YES category:

0 – 2 = Does not influence.

3 – 5 = Does influence (if present with other factors).

6 – 7 = Strongly influences.

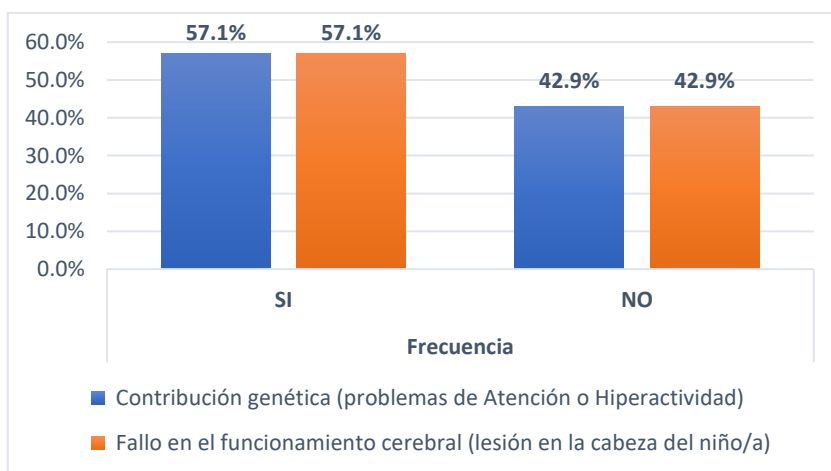


Figure 1

Causal factors that influence the development of ADHD.

Table 2 and Figure 2 show that of the 7 mothers surveyed, 57.1% (4 mothers) indicated that they and/or their child's father have attention deficit hyperactivity disorder (ADHD), implying that they have genetically inherited this attention problem from their child. Also, 57.1% (4 mothers) indicated that their children had suffered a head injury that caused impaired brain function. Therefore, since more than 50% of the children present these two factors, it can be stated that they influence the development of ADHD. Furthermore, the 3-5 interval corroborates this influence. The children's head injuries were due to accidents at home that caused blisters or wounds on their heads.

On the other hand, 42.9% (3 mothers) of the remaining mothers indicated that the indicators of the causal factors have not been present.

3.1.2. Results regarding the first specific objective

Table 2

Survey Results Regarding Prenatal Risk Factors Associated with ADHD

Prenatal Risk Factors	YES	Frequency			Total, of Surveyed Mothers
		%	NO	%	
Tobacco or Alcohol Use During Pregnancy	4	57.1%	3	42.9%	7
Heroin or Cocaine Use During Pregnancy	0	0%	7	100%	7
Poor Maternal Health Status	3	42.9%	4	57.1%	7
Medication use	3	42.9%	4	57.1%	7

Note: Questionnaire for parents.

Intervals for the YES category:

0 – 2 = No influence.

3 – 5 = Influence (if present with other factors)

6 – 7 = Strong influence.

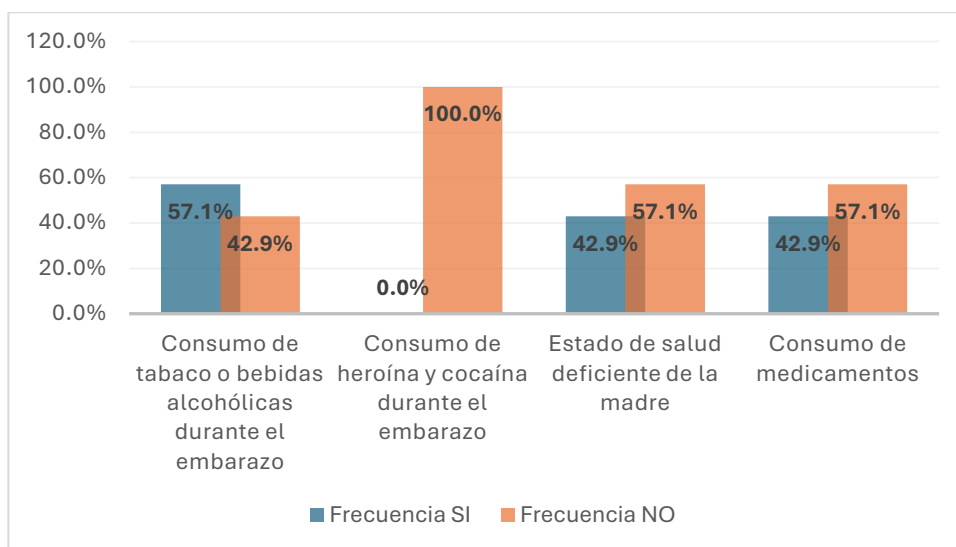


Figure 2

Prenatal risk factors that influence the development of ADHD.

Table 2 and Figure 2 show that of the 7 mothers surveyed, 57.1% (4 mothers) indicated that they consumed alcoholic beverages during their pregnancy. Therefore, it can be stated that this factor influences the development of ADHD, since more than 50% of the children present this indicator, and it falls within the 3-5 range, corroborating the influence. These mothers specified that during their pregnancy they consumed alcoholic substances such as beer or alcohol, some constantly and others occasionally. 42.9% (3 mothers) reported experiencing poor health during their pregnancy and consequently used medications such as paracetamol and ibuprofen. Therefore, it can be concluded that these two factors influence the development of ADHD, as they, along with other factors, increase the likelihood of its occurrence. This influence is further corroborated in the 3-5 age range. These mothers specified that they experienced poor health during their pregnancy because some were injured in a fall, while others had persistent fever and swollen feet, which led them to occasionally use medications such as paracetamol and ibuprofen.

On the other hand, 100% of the mothers indicated that they did not use cocaine, heroin, or any other related substance during their pregnancy. Therefore, it can be concluded that this factor does not influence ADHD.

3.1.3. Results regarding the second specific objective (identification of children with ADHD).

Table 3

ADHD in children in the third cycle of the I.E.P. No. 70047 Huáscar.

Categories	Frequency	Percentage
Children with combined ADHD	2	8 %
Children with inattention	4	16%
Children with hyperactivity	1	4 %
Without either criterion	18	72 %
Total	25	100 %

Note: Observation sheets.

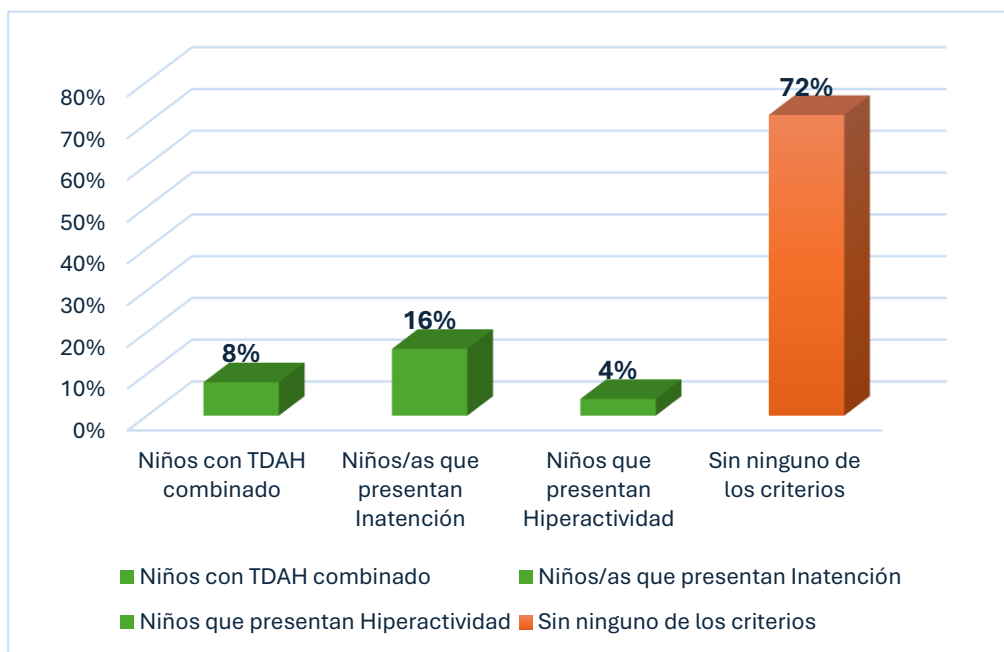


Figure 3

ADHD in children in the third cycle of the Huáscar Primary School No. 70047.

Table 3 and Figure 3 show that of the total sample (100%), 72% did not exhibit any of the criteria, 16% exhibited inattention (attention deficit), followed by 8% who exhibited combined presentation ADHD, while 4% exhibited hyperactivity/impulsivity. Therefore, the percentage of children identified with ADHD is 28% of the research sample.

Children with ADHD frequently presented the following indicators: They have difficulty maintaining attention on tasks such as completing worksheets and answering questions in their textbooks. They begin classroom tasks but are quickly distracted by talking to the person next to them or grabbing objects such as toys. They have difficulty putting their belongings in order. They fidget with their hands, holding a pencil, crayon, or other object. They talk excessively in the classroom. They find it difficult to wait their turn when participating in group activities, games, or physical education. They are unable to sit still for extended periods. They interrupt their classmates' conversations and games.

3.2. Discussion

The results obtained in our research can be compared with those of Rivera (2013) in his psychological study, "Etiology of Attention Deficit Hyperactivity Disorder and Associated Characteristics in Infancy and Childhood," which argues that this disorder is hereditary and that there are also risk factors during pregnancy and birth. In this respect, our research coincides with that finding, as it has concluded that genetic contribution influences the development of ADHD.

However, there are some differences, such as in the results regarding alcohol consumption. In Rivera's study, 20% of the fathers surveyed indicated that this factor was present, while in our study, 57.1% of the mothers indicated that this factor was present. The factors considered in both studies are similar, except for the genetic contribution and impaired brain function. However, these latter factors were considered in the research by Martinhago et al. (2019), Biederman (2005), and the CADAH Foundation (2012) maintain that these factors influence and/or cause ADHD.

The results regarding the identification of children in the third cycle of the I.E.P. No. 70047 "Huáscar" who present with ADHD generally agree with the results of Llanos et al. (2019) in their scientific article, in which children with ADHD were diagnosed in Barranquilla, Colombia. Both studies generally agree on the percentage of children identified with the ADHD subtypes (inattentive, hyperactive, combined), since in our study, predominantly inattentive was identified in 6% of the sample, followed by predominantly hyperactive at 4%, and predominantly hyperactive/impulsive at 8%. While in his scientific article by the same author, it was diagnosed that 5% of his sample showed inattention, 3.1% showed hyperactivity, and 7.3% showed a combined presentation.

IV. Conclusions

After applying the corresponding instruments to the study variables, the following conclusions were reached:

First: Based on the survey and the results obtained, it was determined that the associated factors influencing the development of ADHD are: a greater percentage of genetic

predisposition, followed by head injury in the child, alcohol consumption, poor maternal health, and medication use during pregnancy by the mothers, who indicated that these factors were present in their children who developed ADHD.

Second: It has been determined that the causal factors of genetic contribution and head injury influence the development of ADHD, since the majority of the mothers surveyed indicated that they and/or the father of their children have genetically inherited attention problems. They also indicated that their children had suffered a head injury during their development, and that this injury can cause impaired brain function, altering the ability to focus attention and regulate behavior.

Third: It has been identified that 28% of the research sample presents with ADHD. Of these, according to this percentage, which represents the total number of children identified, Attention Deficit Disorder is the predominant presentation, followed by the combined presentation of Attention Deficit Hyperactivity Disorder (ADHD). A small percentage of these children present with the predominant presentation of hyperactivity/impulsivity. This identified sample was useful for conducting a survey of their mothers to determine the factors that may have caused ADHD in their children.

Ethics statement

I, Edyson Guido Yana Pari, holder of National Identity Document No. 72376692, author of the thesis entitled “Factors Influencing Attention Deficit Hyperactivity Disorder in Children in the Third Cycle of Primary School No. 70047 Huáscar de Puno – 2019,” declare under oath the following:

That this research work has been developed respecting the fundamental ethical principles of honesty, responsibility, academic integrity, and respect for human dignity.

That the information collected during the research process was obtained lawfully, transparently, and for exclusively academic purposes.

That the confidentiality and anonymity of the children, parents, teachers, and other participants involved in the study were respected, safeguarding their personal data.

That, since the participants were minors, the corresponding authorization was obtained from their parents and the educational institution for the application of the research instruments. I declare that the results presented are truthful, original, and accurately reflect the information obtained, without manipulation, alteration, or plagiarism.

I declare that all bibliographic sources used have been duly cited and referenced in accordance with current academic standards.

I assume full responsibility for the content of this research and any observations arising from it.

Acknowledgments

To my alma mater, the National University of the Altiplano, for giving me the opportunity to pursue my professional training in the welcoming classrooms of the School of Primary Education.

To professor Ofelia Marleny Mamani Luque, for her guidance in conducting this research, and to the members of the jury who guided and strengthened the writing of this thesis.

To the faculty of the School of Primary Education for their teaching, their advice, and for the achievements obtained each semester, which contribute to my professional development as a teacher.

To my parents, who gave me their unconditional moral support every day to achieve this goal.

To the children and parents of the third cycle of Primary School No. 70047 in Huáscar, who contributed their data to this research as part of the study sample.

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Music Culture and Artistic Pedagogy



Virtual Education Influence on the Students' Academic Satisfaction in the Professional Dance Program at ESFAP Puno, 2022

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ABSTRACT

Virtual education, grounded in socio-constructivist and technological approaches, conceives learning as an active process mediated by interaction, autonomy, and digital environments; in this context, academic satisfaction depends on pedagogical, technological, and motivational factors whose proper integration directly influences its achievement, particularly in artistic fields such as dance. The objective of this study was to determine the extent to which virtual education influences the academic satisfaction of students in the Professional Dance Program at the “Escuela Superior de Formación Artística Pública (ESFAP) Puno” during 2022. The study followed a basic, quantitative, non-experimental, descriptive-explanatory design, analyzing the relationship between virtual education and academic satisfaction in an intentional sample of 60 out of 106 students, using surveys and observation with validated, reliable instruments, and applying descriptive and inferential statistics, including the Student's t-test for hypothesis testing. The results showed virtual education significantly influences students' academic satisfaction, confirmed by the Student's t-test at 95% confidence. Perceptions were mostly medium and high (33.3%, 36.7%, 28.3%). The virtual environment supports learning (30%–36.7%), though some face difficulties (8.3%–11.7%). Teacher support is positively valued (28.3%–36.7%), and digital competencies directly impact satisfaction (25%–33.3%), despite minor limitations. Overall, satisfaction depends on environment quality, teacher support, and digital competencies. The study concludes that virtual education significantly influences the academic satisfaction of students in the Professional Dance Program at ESFAP Puno, with the virtual environment, teacher support, digital competencies, course environment quality, and pedagogical interaction identified as key determinants, despite existing technological limitations.

Keywords: Academic satisfaction, digital competencies, teacher support, virtual education, virtual environment.

I. Introduction

Virtual education constitutes a mode of instruction grounded in digital environments that mediate pedagogical interaction, transforming traditional teaching–learning dynamics. From a socio-constructivist perspective, learning is not a passive process of information reception but an actively constructed and socially mediated process (Vygotsky, 1978). In virtual environments, this mediation occurs through synchronous and asynchronous platforms that enable interaction, feedback, and collaboration.

Complementarily, constructivist epistemology posits that learners cognitively reorganize information based on their prior schemas (Piaget, 1970), implying that virtual instructional design must incorporate progressive didactic sequences. In the same vein, meaningful learning theory suggests that new information acquires significance when it is substantively integrated into the learner's cognitive structure (Ausubel, 1968), a condition that is essential in virtual modalities where autonomy is greater.

Discovery learning (Bruner, 1960) becomes particularly relevant in virtual platforms that incorporate interactive resources, while experiential learning (Kolb, 1984) helps explain how artistic disciplines such as dance can be adapted to digital environments through reflective practice, guided observation, and audiovisual feedback.

From the theory of distance education, the quality of the virtual learning process depends on the levels of dialogue, structure, and autonomy (Moore, 1993); when dialogue is high and structural rigidity is low, the educational experience tends to be perceived as more satisfactory. Similarly, the guided interaction proposed by Holmberg (1989) emphasizes the role of teacher support in non-face-to-face contexts.

The Community of Inquiry model posits that the quality of virtual learning depends on cognitive, social, and teaching presence (Garrison, Anderson, & Archer, 2000), and the absence of any of these dimensions negatively affects the perceived quality of the educational process.

From a connectivist perspective, learning in the digital era occurs through interconnected information networks (Siemens, 2005; Downes, 2007), which explains how students develop digital competencies that influence their evaluation of the virtual learning experience.

At the technological level, the acceptance of virtual platforms depends on perceived usefulness and ease of use (Davis, 1989), while the extension of this model incorporates social factors and facilitating conditions (Venkatesh et al., 2003), which are relevant in explaining differences in satisfaction levels.

Likewise, the adoption of educational innovations follows patterns of social diffusion (Rogers, 2003), while the contemporary context of the network society redefines forms of educational interaction (Castells, 1996).

Academic satisfaction is understood as the cognitive and affective evaluation that students make of their educational experience. From the theory of student involvement, active participation increases the perception of satisfaction (Astin, 1993), while academic and social integration influences persistence and positive evaluation of the educational process (Tinto, 1975).

From expectancy theory, satisfaction emerges when achieved outcomes meet or exceed initial expectations (Vroom, 1964), and in higher education, the quality of teacher–student interaction constitutes a determining factor (Pascarella & Terenzini, 2005).

The perceived quality of educational services can be analyzed through dimensions such as reliability, responsiveness, and empathy (Parasuraman, Zeithaml, & Berry, 1988); in virtual modalities, these dimensions are reflected in timely feedback, methodological clarity, and adequate technical support.

From self-determination theory, satisfaction increases when the needs for autonomy, competence, and relatedness are fulfilled (Deci & Ryan, 2000), which is particularly relevant in virtual education, where autonomy is greater but may be compromised in the absence of teacher support.

Academic self-efficacy influences perceptions of achievement (Bandura, 1986), while well-being and positive emotions strengthen the educational experience (Seligman, 2011); from a broader motivational perspective, satisfaction can also be linked to the fulfillment of hierarchical needs (Maslow, 1943).

From a descriptive–explanatory approach, virtual education influences academic satisfaction through pedagogical, technological, and motivational mechanisms.

Alignment between objectives, methodology, and assessment directly impacts the perception of quality (Biggs, 1999), while appropriate multimedia design enhances understanding and learning experience (Mayer, 2009), and meaningful interaction strengthens student engagement (Bonk, 2009; Graham, 2006).

In artistic contexts such as dance, where bodily demonstration and immediate feedback are essential, perceived teaching quality constitutes a key predictor of satisfaction (Ramsden, 1991); contemporary research shows that effective virtual interaction increases positive perceptions of learning (Jung, 2011; Keengwe, 2020).

In summary, virtual education influences academic satisfaction when it integrates coherent pedagogical design, meaningful interaction, adequate technological support, and intrinsic motivation.

II. Methodology

The research was basic in nature, with a quantitative approach, a non-experimental design, and a descriptive–explanatory level. The relationship between virtual education

(independent variable) and academic satisfaction (dependent variable) was analyzed without deliberate manipulation of variables.

The population consisted of 106 students from the Professional Program of Artistic Education, Dance Specialization, at ESFAP Puno (2022-I). The sample was non-probabilistic and intentional, comprising 60 students from the third, fifth, and seventh semesters.

For data collection, the survey technique was employed through a structured questionnaire to measure perceptions of virtual education, and observation was used through a checklist designed to assess academic satisfaction. The instruments were validated by expert judgment and subjected to reliability analysis.

Data processing was carried out using descriptive statistics (frequencies and percentages) and inferential statistics, applying Student's *t*-test to test the research hypothesis.

III. Results and Discussion

3.1. Results

This section presents the results obtained from the research on the influence of virtual education on the academic satisfaction of students in the Professional Dance Program at ESFAP Puno, 2022. The data were organized according to the established objectives and are presented through tables and graphs to facilitate better understanding.

Table 1

Level of Perception of Virtual Education

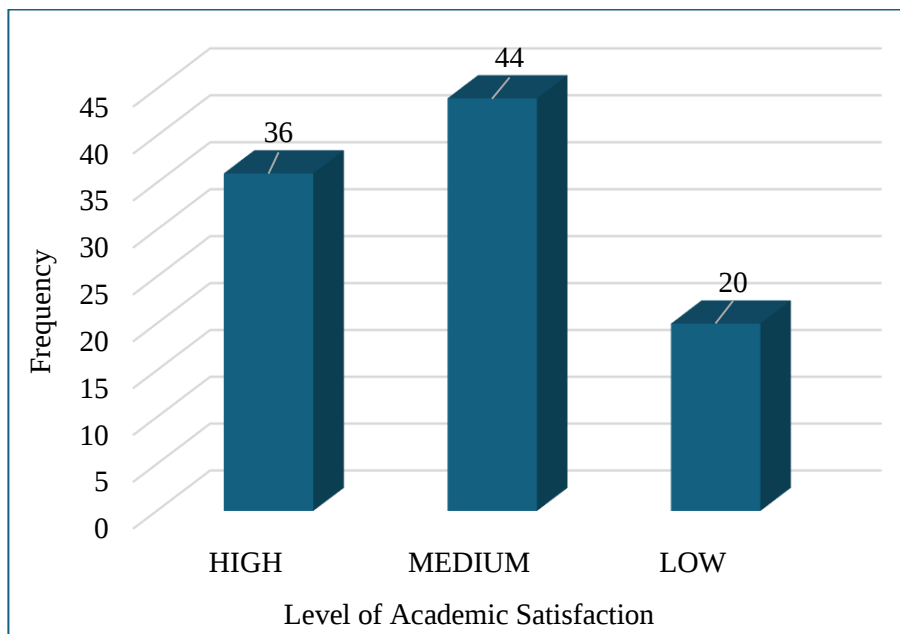
Level	Frequency	Percentage
High	18	36%
Medium	22	44%
Low	10	20%

Note: Questionnaire administered to students of the Professional Program in Artistic Education, Dance Specialization.

Interpretation: The table shows that the majority of students perceive virtual education at a medium level (44%), followed by a high level (36%), while 20% perceive it at a low level. This indicates that, overall, virtual education is viewed from an acceptable to positive standpoint by more than half of the students (80% at medium and high levels); however, a significant group still holds an unfavorable perception, which may be associated with limitations in access, the use of technological tools, or difficulties in the development of virtual classes.

Figure 1

Level of Perception of Virtual Education



Interpretation: The figure reinforces the findings presented in the table, showing that the predominant level of perception of virtual education falls within the medium category (44%), followed by the high level (36%) and, to a lesser extent, the low level (20%). Visually, a favorable trend can be observed, as the greatest concentration lies between the medium and high levels, indicating that most students maintain an acceptable evaluation of virtual education. However, the presence of 20% at the low level reveals that there are still difficulties affecting the perception of a group of students, suggesting the need to strengthen aspects such as teacher support, technological conditions, and the quality of virtual learning environments.

Table 2

Level of Academic Satisfaction

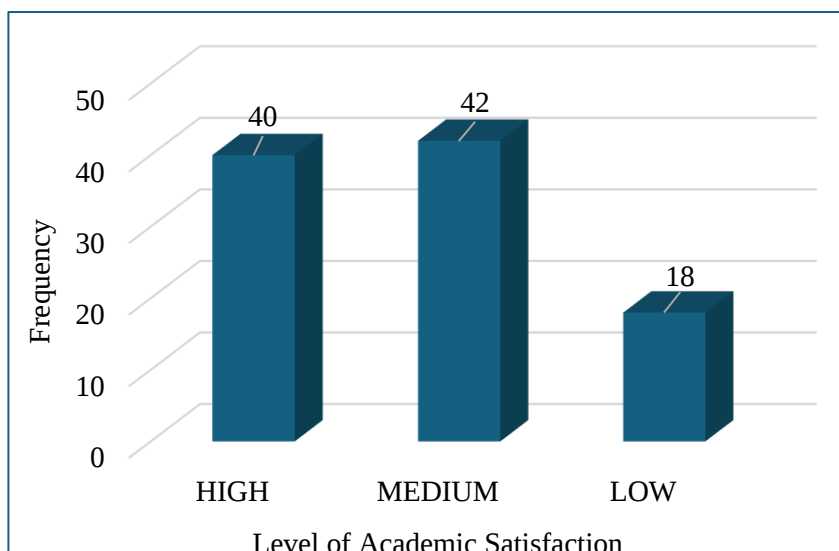
Level	Frequency	Percentage
High	20	40%
Medium	21	42%
Low	9	18%

Observation checklist: administered to students of the Professional Program in Artistic Education, Dance Specialization.

Interpretation: The table shows that the level of students' academic satisfaction is mainly concentrated at the medium level (42%), closely followed by the high level (40%), while 18% fall within the low level. This indicates that the majority of students (82%) report a level of satisfaction ranging from acceptable to high regarding the educational service received, reflecting a generally positive assessment of the learning process. However, the proportion at the low level suggests that there are still areas requiring improvement, possibly related to the quality of teaching, teacher support, or the conditions of the virtual learning environment.

Figure 1

Level of Academic Satisfaction



Interpretation: The figure complements the table by visually showing that the level of academic satisfaction is primarily concentrated in the medium category (42%), closely followed by the high level (40%), while the low level (18%) represents the smallest proportion. This distribution confirms a favorable trend, as the majority of students are positioned within positive levels of satisfaction, reflecting an acceptable evaluation of the educational process. However, the presence of a group at the low level suggests that certain difficulties still persist and need to be addressed, particularly in aspects related to teaching quality, the virtual learning environment, and teacher support.

3.2. Discussion

The results show that virtual education significantly influences students' academic satisfaction, which is consistent with the findings of Valdez (2018), who identified a strong positive relationship between virtual education and student satisfaction,

confirming its relevance in educational processes. However, satisfaction levels remain within a medium range, which can be explained by limitations such as connectivity issues, limited access to technological devices, and insufficient command of digital tools, a situation similar to that reported by Mamani and Maquera (2021), who highlight that virtual education presents challenges due to students' technological conditions.

Furthermore, it is confirmed that teacher support and the quality of the virtual learning environment are key factors in students' perceptions, in line with Morales et al. (2016), who argue that interaction and the appropriate use of ICT enhance learning. Nevertheless, in the context of artistic education, particularly in dance, virtual education presents significant limitations, as Beetham and Sharpe (2013) point out that although it optimizes learning time, it does not fully replace the practical, face-to-face experience.

Additionally, the findings related to the virtual learning environment are consistent with those of Cedeño and Murillo (2019), who state that virtual environments facilitate learning management and interaction between teachers and students; in this study, students positively value these environments, although this perception does not reach fully high levels, which may be explained by the limited use of digital platforms, as noted by Huanca (2019), who found that students are familiar with various virtual platforms but do not fully utilize them for critical learning, instead using them in a more operational manner.

Likewise, regarding digital competencies, the results align with those reported by Apaza and Auccapuma (2018), who conclude that the effective use of virtual tools influences student learning; although this study shows an acceptable level of digital skills, there are still gaps that limit the optimal use of virtual education. This is also related to Cabero (2010), who argues that the effective use of ICT involves not only access to technology but also the development of skills to manage, understand, and apply information in educational contexts.

Consequently, virtual education constitutes a valid but insufficient alternative on its own, which reinforces the need to implement hybrid models that integrate face-to-face instruction with the use of technology, thereby enabling a more comprehensive form of training aligned with the demands of artistic education.

IV. Conclusions

Virtual education significantly influences students' academic satisfaction, as it ensured the continuity of the educational process in a context of crisis, guaranteeing access to instruction despite sanitary restrictions. However, the level of satisfaction largely depends on the quality of the virtual environment and the degree of teacher support, both of which are essential to guide, motivate, and ensure an adequate and meaningful learning experience.

Despite its benefits, there are technological limitations such as lack of connectivity, restricted access to appropriate devices, and insufficient mastery of digital tools, which negatively affect learning and generate inequalities among students. Furthermore, in practice-based artistic programs such as dance, virtual education proves insufficient due to the need for physical interaction, direct feedback, and bodily development, which are difficult to replicate through digital means.

Therefore, it is necessary to move toward hybrid educational models that combine virtual and face-to-face modalities, strategically integrating the use of technology with practical spaces, thereby strengthening the training process and responding more effectively to the specific demands of this type of discipline.

Ethical Statement

This research has complied with the necessary ethical requirements at all its stages, from planning, data collection, and analysis to the presentation of results. Its development has been based on principles of transparency, academic honesty, and scientific responsibility, ensuring at all times respect for the rights of the participants involved in the study.

Likewise, voluntary participation of students was ensured, avoiding any form of coercion, and the confidentiality and anonymity of the information provided were safeguarded. The data obtained were used exclusively for academic and research purposes, preventing any misuse or manipulation. In this way, the study adheres to the fundamental ethical principles that govern scientific research, promoting respect, integrity, and the veracity of the results.

Acknowledgements

I express my profound gratitude to God for granting me life, health, and the strength necessary to complete this research. I also thank the teachers and students of the Dance Specialization at the Escuela Superior de Formación Artística Pública of Puno, who significantly contributed to the development of this study.

I especially acknowledge the support and guidance of my thesis advisor, for her valuable contributions and continuous accompaniment throughout the entire research process. Likewise, I extend my gratitude to the institution's authorities for facilitating the necessary conditions for the execution of this work.

Finally, I thank my family for their understanding, constant support, and motivation, which were fundamental in achieving the completion of this academic objective.

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Analysis of the Melody and Harmony of the Secondary Voices in the 'Primicias 2021' Mix by the Gran Banda Instrumental Mi Perú

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ABSTRACT

This research addresses the melodic and harmonic structure of the second and third voices in the "Primicias 2021" mix of Morenadas, performed by the Gran Banda Instrumental Mi Perú, a representative group from the Puno region. This study arises due to the lack of technical knowledge regarding the harmonization of these voices in local bands, despite their relevance in the sound of the Morenada genre. The main objective is to analyze the relationship between the secondary voices and the main melody, understanding their role in the sound configuration and their contribution to cultural musical identity. The methodology used is qualitative, employing direct observation, auditory analysis, and documentary review, with tools such as audio and video recordings, verification sheets, and sheet music. Three representative compositions were selected: "Morenada La Plana Mayor," "Morenada Virgencita de la Candelaria," and "Morenada Señor de Exaltación." The results indicate that the secondary voices, using intervals of third and fifth in the construction of chords, enrich the musical texture. Additionally, it was observed that instruments like the bombardinos, trumpets, and tuba play a crucial melodic role, reflecting a technical evolution that preserves the tradition of the Morenada. It is concluded that these voices not only enrich the work but also strengthen the artistic and cultural value of the genre.

Keywords: Bombardinos, brass wind, harmonization, instrumental band, morenadas.

I. Introduction

The Morenada, with its melodic and harmonic characteristics, is a fundamental pillar for the cultural identity of Puno, reflecting both traditions and ancestral beliefs (Miranda, 2015). This genre has evolved significantly, adapting to new contemporary proposals without losing its roots (Vargas, 2023). The Gran Banda Instrumental Mi Perú, representative of the region, plays a crucial role in the preservation and

dissemination of the Morenadas, merging traditional rhythms with innovative musical arrangements (Gutiérrez & Ramírez, 2017). In this context, the research focuses on the secondary voices (second and third voices) in the Morenada mix, with the objective of understanding their melodic and harmonic structure, and how they interrelate with the main voice (Serrano, 2020). Analyzing these secondary voices is essential as they contribute to sonic cohesion and enrich the melodic texture, key elements in traditional Morenada (Choquehuanca, 2021). Despite their importance, local bands face technical limitations, especially in the execution and harmonization of secondary voices, which affects musical quality (Quispe, 2019). This study aims to address this issue by analyzing the "Primicias 2021" mix of the Gran Banda Instrumental Mi Perú, with the goal of improving the interpretation of the Morenadas and strengthening the preservation of the sonic richness of the region's folklore (Flores, 2020). The research proposes the general problem as: How do the second and third voices influence the melodic and harmonic structure of the "Primicias 2021" Morenada mix, and how do they contribute to preserving the musical identity of the Andean tradition? (Ayala, 2017).

This study aims to analyze the influence of the second and third voices on the melodic and harmonic structure of the "Primicias 2021" Morenada mix by the Gran Banda Instrumental Mi Perú, and their contribution to preserving the Andean musical identity. It will investigate how these voices impact the melodic and harmonic interaction, relating to the main melody and the resources used to create tension, variation, and resolution in the piece. The band plays a crucial role in preserving the Morenada, and its analysis of secondary voices offers a new perspective on how innovations are integrated into traditional structures. This work is relevant for musicians, composers, and scholars, as it deepens the legacy of the Morenadas in the Puno region. Specific objectives include analyzing the melodic and harmonic structure of the secondary voices (trumpets, bombardinos, and tuba), identifying the melodic and harmonic resources that maintain the sonic authenticity of the Morenada.

Apaza (2023) analyzed the folk music of the Morenada fraternities, highlighting the constant interaction between tradition and modernity, influenced by the music market. Pérez and García (2018) examined the development of harmony and counterpoint in Latin American popular music, emphasizing the relevance of secondary voices in musical ensembles. Serrano (2020) studied harmonic voices in traditional bands from Mexico City, demonstrating how these contribute to regional identity and sonic cohesion. Martín and Púa (2010) provided an analysis of the use of harmony in popular music, especially in tangos, highlighting the importance of modulation and harmonic progressions.

Núñez (2015) discussed how music influences the interpretation of visual content, emphasizing its power in creating subjective experiences. Grajales (2015) analyzed the ensemble process in a duet, focusing on the structural and technical progress of the

musical repertoire. Vargas (2023) explored musicalization in the series *Euphoria*, highlighting the importance of music in transmitting the narrative message.

Porcel (2021) examined factors that favor or restrict the progress of female instrumentalists in Andean music, with special emphasis on the role of women. Zamudio (2021) identified musical resources that generate new aesthetics in Shai Maestro's repertoire, contributing to contemporary jazz. Vargas (2019) investigated the works of the Four Greats of Cusco, analyzing their relationship with regional musical identity and their influence on musical nationalism. Carrasco (2019) studied how music and image interact in a documentary film, emphasizing the importance of their independent analysis.

Gutierrez and Ramírez (2017) analyzed harmony in *Fantasia del escribano* by Jaime Romero, comparing it to traditional Colombian instrumental pasillo standards. Romero (2015) emphasized the importance of ethnomusicology and its contribution to the analysis of social and cultural phenomena. Alanoca and Gómez (2024) analyzed the impact of the pandemic on the music of folk groups in Puno, showing how form and harmony were adapted during this period. Machaca (2021) focused on the technical training of the clarinet in the Azángaro bands, identifying common challenges in execution.

Quispe (2019) researched harmonic characteristics in Puno bands, highlighting the role of accompaniment voices in the Morenada. Flores (2020) analyzed the relevance of harmonic voices in the Morenada, showing how traditional bands maintain a solid harmonic structure despite musical evolution. Choquehuanca (2021) studied the interaction of melodic voices in instrumental Morenada ensembles, emphasizing how secondary voices contribute to the polyphony of the work.

Suaña (2019) examined the role of the euphonium in Puno bands, concluding that it is crucial for interpreting popular genres in the region. Cahua (2019) analyzed the Virgen de la Candelaria festival through a programmatic musical work, showing how music reflects the festival's main characteristics and acts. Finally, Ayala (2017) studied the empirical music of local collectives in Puno, highlighting technical limitations but also emphasizing the good use of traditional timbres such as the charango and guitar.

Musical composition, according to Quispe (2013), is an artistic process that involves three stages: conception, organization, and realization. Conception includes both a synthetic and an analytical approach, allowing the musician to develop and organize musical ideas. For the symphonic musician, this involves defining the directives and constructive components of the piece, which can be adjusted as the work evolves. Musical analysis, as defined by Bent (1980) and cited by Manco (2015), is the process of breaking down a musical structure into its simplest components, exploring its functions within the overall structure. Burmeister (1629) defines analysis as the decomposition of a piece into a specific mode, while Suaña (2019) notes that

instruments may present physical limitations affecting their execution, especially in instruments like the tuba and bombardino. Roca (1994) mentions that analysis should consider harmony, melody, rhythm, and form, and Randel (1994) adds that it is essential to identify the chords within the scale and their interactions. Melody, according to Rubertis (1937, cited by Suaña, 2019), is a coherent succession of tones and rests with its own identity that evolves within a composition. Benward & Saker (1989) state that in ensemble music, secondary voices provide melodic support, while instruments like trumpets perform the main melody. Harmony, as explained by Rubertis (1937), combines simultaneous notes to form chords and harmonic sequences, enriching the sonic texture of the work. Piston (1987) notes that while harmony in popular music can be simple, it is still powerful in evoking emotions. McPherson & Thompson (1998) highlight that harmony emerged in the transition from monophony to more complex melodies, and Piston (1987) concludes that tonal harmony solidified during the Baroque period, becoming the central axis of Western music.

The Morenada, typical of the South American Andean region, is a vibrant dance reflecting daily life through its music and rhythmic steps. Brass bands, essential to the festivities, combine wind and percussion instruments, with some ensembles adding strings such as double basses and violins. These bands, crucial in celebrations like the Virgen de la Candelaria in Puno, have been key in sharing sonic codes between Andean peoples. While the introduction of brass bands in rural areas has reduced the use of indigenous instruments like sikus and tarkas, the Morenada remains a shared cultural heritage among highland Andean communities. Additionally, European music, such as Italian opera, contributed to the formalization of music in Latin America during the 19th century (Miranda, 2015). The Morenada is also associated with social groups that have experienced significant economic mobility since the second half of the 20th century, especially the Aymara people who have emerged as a new economic elite in cities like La Paz (Valenzuela, 2020). The dance of the Morenada involves high financial costs, mainly for costumes made by specialized artisans, whose cost increases every year (Valenzuela, 2020). Despite the importance of musical creation in the Morenada, it is often relegated in educational programs that focus more on interpretation, limiting the recognition of composition as a valuable process (Giráldez, 2009). The musical language of the Morenadas reflects not only cultural expression but also economic power and social status, as seen in lyrics like "Hay que bailar moreno," which emphasize the financial effort required to participate in these traditions (Alfaro, 2015). Music bands in Puno, originating from migrant Aymara communities, played a key role in the Virgen de la Candelaria festivities. Over time, Puno's bands have achieved international recognition, contributing to the dissemination of the region's folklore, as evidenced by the Banda Super Liberal's performance in Paris in 2001. The Gran Banda Instrumental "Mi Perú," founded in 2011 by Professor Víctor Raúl Mamani Mamani, has become a musical reference in the region, significantly contributing to the preservation and dissemination of Puno's musical heritage.

II. Methodology

The research used the method of musical content analysis, employing two main techniques: direct observation with auditory analysis and documentary analysis. Direct observation allowed for the examination of recordings from the Primicias Morenadas 2021 mix, while the documentary analysis focused on the sheet music and arrangements of the compositions. The design of the study was non-experimental and cross-sectional, with a simple descriptive approach to observe and describe the characteristics and phenomena of the compositions, with the aim of laying the foundation for future research. The melodic structure was analyzed, including phrases, motifs, and periods, as well as harmonic analysis, which identified tonalities, chords, and their functions. The unit of analysis consisted of three representative compositions from the contemporary folk repertoire of Puno: "Morenada La Plana Mayor," "Morenada Virgencita de la Candelaria," and "Morenada Señor de Exaltación." The data collection techniques included repeated listening, transcription of sheet music, identification of melodic motifs, and comparative analysis. The processing of the information was done using tools such as structured observation sheets and analysis matrices. The results showed that Primicias Morenadas 2021 reflects significant technical and cultural richness, evidencing the musical tradition of Puno and its evolution within the boundaries of Andean folklore.

III. Results and Discussion

3.1. Results

3.1.1. Melodic Structure and Harmonic of the "La Plana Mayor" Morenada

The "La Plana Mayor" Morenada presents a clear question-and-answer structure in its first phrases, with melodic variations that allow for continuous progression. The 2/4 binary rhythm is constant, providing a stable and danceable pulse, while the trumpets set an energetic rhythm, and the bombardinos and tuba provide solid harmonic support. The repetitive and varied melodic motifs maintain the cohesion of the piece, while the main key of C minor and the harmonic movements of tension and resolution add depth. The instrumentation complements the melodic and harmonic texture, with the trumpets leading the melody and the bombardinos and tuba offering a solid foundation. Together, the work effectively uses secondary voices to create tension, contributing to the cohesion and identity of the Morenada genre.

3.1.2. Melodic Structure and Harmonic of the "Virgencita de la Candelaria" Morenada

The "Virgencita de la Candelaria" Morenada follows a clear melodic structure, with three phrases divided into question-and-answer semi-phrases. The trumpets lead the first two phrases, and the bombardinos and tuba take center stage in the third. The 2/4 rhythm remains constant, with the trumpets marking an energetic rhythm and the

bombardinos and tuba providing solid and deep harmonic support. The melodic motifs repeat and vary throughout the piece, with effective use of the secondary voices that enrich the texture and cohesion of the work. The main key is E minor, with harmonic variations that introduce tension and resolution, employing the functions of tonic, subdominant, and dominant in a traditional manner. The instrumentation stands out for the complementary role of the trumpets, bombardinos, and tuba, creating a dynamic balance between the melodic and harmonic voices.

3.1.3. Melodic Structure and Harmonic of the "Señor de Exaltación" Morenada

The "Señor de Exaltación" Morenada presents a melodic structure divided into three phrases, each with a question-and-answer pattern. The trumpets lead the first two phrases, and the bombardinos and tuba assume the melodic role in the third. The piece modulates to C minor at measure 57, marking the transition to the third Morenada. The 2/4 binary rhythm remains constant throughout the piece, with rhythmic variations in the trumpets and a more simplified rhythm in the bombardinos and tuba. The melodic theme alternates between the trumpets and the bombardinos, creating timbral contrasts and enriching the work. The harmonic structure follows a traditional progression of tonic-subdominant-dominant, with secondary chords that introduce tension and resolve to the tonic. In terms of instrumentation, the trumpets lead the melody, while the bombardinos and tuba provide harmonic support, especially in measures 75-83, where they take on a melodic role with a deeper and more solemn texture.

3.2. Discussion

The research on the harmonization of the secondary voices in the mix Primicias Morenadas 2021 by the Gran Banda Instrumental Mi Perú shows how the morenada follows a classical harmonic structure, adapted to the particularities of the Andean region. The secondary voices, performed by the bombardinos, trumpets, and tuba, reinforce the sonic cohesion and contribute to the cultural identity of the genre, as highlighted by authors such as Quispe (2019) and Choquehuanca (2021). The analysis shows that the secondary voices in the morenada, similar to those in the music of Latin American groups studied by Ayala Luna (2017), are key to creating a rich sound. The music, although simple in its harmonic structures, continues to transmit cultural identity and adapts to contemporary contexts, as emphasized by Giraldes (2009).

3.2.1. Morenada La Plana Mayor

It uses tonic, subdominant, and dominant chords, ensuring a stable harmonic progression. The authentic cadences and the key of C minor give it a melancholic character, while the secondary voices enrich the piece.

3.2.2. Morenada Virgencita de la Candelaria

The modulation to E minor introduces a tonal variation that expands the expressive possibilities, maintaining harmonic cohesion through the tonic-subdominant-dominant

cycle. The interaction of the voices supports the flexibility of the genre to adapt to new sonic expressions.

3.2.3. Morenada Señor de Exaltación

The modulation to C minor adds a solemn and deep tone to the piece. The alternation between the trumpets, bombardinos, and tuba, along with the use of traditional intervals, reinforces the harmonic structure, while the authentic cadences and modulations bring freshness without losing the essence of the morenada.

IV. Conclusions

The research conducted on the analysis of the harmonization of the secondary voices in the Primicias Morenadas 2021 mix of the Gran Banda Instrumental Mi Perú has allowed for a deeper understanding of the melodic and harmonic structure of the Morenada, revealing that, despite following a classical harmonic structure, the work presents adaptations that reflect the particularities of the Andean region. It is concluded that the secondary voices play a crucial role in creating the harmonic texture, adding depth and dynamism to the main melody. This analysis has shown that, by using traditional intervals like thirds and fifths, the secondary voices reinforce the cohesion of the piece and significantly contribute to the preservation of the cultural identity of the Morenada genre.

Through the melodic and harmonic analysis, the interaction between the trumpets, bombardinos, and tuba was highlighted, which, by alternating protagonism and creating timbral contrasts, enriches the piece and strengthens its artistic and cultural value. However, it is acknowledged that the study has limitations, primarily due to the selection of only three representative compositions, which may not reflect the entirety of the variations within the band's repertoire.

It is suggested that future research be expanded to a more exhaustive analysis of other compositions from the Gran Banda Instrumental Mi Perú's repertoire, as well as a comparison with other regional ensembles. It is also recommended to further investigate the impact of technical innovations on the secondary voices, especially in instrumentation, to continue strengthening the interpretation and preservation of Andean music in contemporary contexts. Overall, this study contributes to the understanding and appreciation of the Morenada as a vehicle for cultural identity, and opens new lines of research on how folk music can adapt without losing its essence.

Ethical Statement

This research was conducted in strict compliance with the ethical principles governing scientific practice. Throughout the process, transparency in procedures, responsibility in handling information, and full respect for the rights of all involved parties were ensured. It is guaranteed that:

- Participants are treated with dignity, respect, and consideration, protecting their integrity and well-being.
- The information obtained is handled confidentially and used solely for academic and scientific purposes.
- The results and conclusions are presented transparently, avoiding any form of manipulation or bias.
- The cultural, social, and personal diversity of participants and collaborators is respected.
- The principles of justice, equity, and mutual respect are upheld in every phase of the study.

Acknowledgments

I express my deepest gratitude to all the people who supported me throughout my professional training. I particularly acknowledge with gratitude Dr. Benjamín Velazco Reyes and M.Sc. Erich Feliciano Morales Quispe, whose valuable guidance and support were fundamental in both my development as a musician and in my studies at the Universidad Nacional del Altiplano de Puno. I hold both of them in sincere respect and eternal gratitude.

Likewise, I extend my recognition to my brothers Néstor and Javier, essential pillars in my musical and academic growth. Thanks to their unconditional support and constant encouragement, I was able to consolidate my professional training at the Escuela Profesional de Arte – Música.

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Musical Stage Fright in students of the Tenth semester of the Music Education program at an art school in Puno, 2025

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ABSTRACT

This research had as objective: To determine the level of music performance anxiety (MPA) and to analyze its three main dimensions (early performance context, generalized psychological vulnerability and performance-specific worry) in tenth-semester students of Music Education at an art higher school in Puno, Peru, in 2025. Method: Quantitative, descriptive, non-experimental, cross-sectional study. Census sample (n = 24; 96 % of the population of 25 students). The 26-item Spanish version of the Kenny Music Performance Anxiety Inventory (K-MPAI) was applied. Results: 58.3 % showed low overall MPA and 41.7 % moderate; no high cases were recorded. The three dimensions were predominantly moderate: early experience context (87.5 %), generalized psychological vulnerability (91.7 %) and worry about performance (66.7 %). Conclusion: Students exhibit mostly controlled and functional performance anxiety, although there are margins for improvement in emotional stability and stage self-confidence. The systematic incorporation of emotional regulation programs in music teacher training is recommended.

Keywords: K-MPAI, music performance anxiety, music students, teacher training.

I. Introduction

Music constitutes

a complex language that integrates cognitive, motor, and perceptual processes essential for the holistic development of students. At the global, national, and local levels, according to (Hallam, 2010), (Valdivia Aguirre, 2024), Viana (2024), Aponte (2022), (Nina & Carlos, n.d., p. 30), (Yépez, 2020, p. 15), and (Rodríguez Riveros, 2022, p. 27), studies related to arts education indicate that theoretical mastery and rhythmic ability become fundamental elements for precise musical performance, especially in school ensembles where synchronization and cohesion are essential. However, in various educational institutions, gaps persist between what is taught theoretically and

what is applied in instrumental practice, generating difficulties in collective musical performance.

Music performance anxiety (MPA), also known as music performance anxiety (AEM in Spanish), is one of the most common psychological problems among musicians of all levels. It is characterized by the activation of cognitive responses (catastrophic thoughts), affective responses (intense fear), and physiological responses (tachycardia, trembling, sweating) that can significantly impair performance quality (Kenny, 2023). Systematic reviews indicate prevalence rates of debilitating forms ranging from 16.5% to 60% in professional musicians (Fernholz et al., 2019) and up to 21% of severe cases in students (Kenny & Osborn, 2025).

In Latin America, and particularly in Peru, studies have shown medium to high levels of MPA in music students. Arias and Cáceres (2021) reported 71% high anxiety levels at the conservatory of Arequipa, while Hallasi (2022) found 65.6% medium levels and 26.1% high levels at the National University of San Agustín. Both studies agree on the absence of institutional psychological support programs as an aggravating factor.

The present study is conducted in a little-explored context: a public higher artistic education institution in the Andean region of Puno, where final-year students simultaneously face the academic pressure of evaluated recitals and preparation for their future teaching role. Since future music teachers will serve as models for their students, managing their own MPA is crucial to break intergenerational cycles of performance anxiety transmission.

The theoretical framework adopted is Barlow's (2002) triple vulnerability theory, adapted by Kenny (2023) to the musical context, which posits that MPA arises from the interaction between (a) general biological vulnerability, (b) early psychological vulnerability (family and early educational experiences), and (c) performance-specific vulnerability. This model is operationalized through the Kenny Music Performance Anxiety Inventory (K-MPAI), which measures exactly the three dimensions used in this study.

The general objective was to determine the level of music performance anxiety in tenth-semester students of Artistic Education – Music in Puno, 2025.

II. Methodology

The study adopted a quantitative approach with a descriptive, non-experimental, and cross-sectional design (Hernández-Sampieri and Mendoza, 2018; Espinoza-Casco et al., 2023). The deductive method was employed, based on the theoretical framework regarding musical performance anxiety to empirically measure this variable in its natural state, without manipulation or the establishment of causal relationships.

The population consisted of the 25 students enrolled in the tenth semester of the Art Education—Music program at a higher arts school in Puno (Peru) in 2025. Non-

probability census sampling was used, including the entire population as the sample (N = 25).

The study variable was musical performance anxiety, operationalized using the Spanish version of the Kenny Music Performance Anxiety Inventory (K-MPAI; 26 items, 7-point Likert scale). This instrument assesses the general level of anxiety and three specific dimensions: (1) context of early experiences, (2) generalized psychological vulnerability, and (3) performance concern.

Data collection took place at a single point in time (2025) after obtaining institutional authorization and informed consent from the participants. The questionnaire was administered in group sessions during school hours, under the researcher's supervision, with an estimated duration of 20–25 minutes per student. Neutrality in administration and anonymity of responses were ensured. The data were coded in Microsoft Excel 2024 and analyzed using IBM SPSS Statistics version 27. Prior to analysis, the reverse-scored items (2, 9, 14, 17, 24, and 26) were recoded using the formula: reverse score = 8 – original score. Descriptive statistics (means, standard deviations, and frequencies) were calculated for the overall score and for each dimension. Anxiety levels were classified as low, moderate, and high according to the ranges established in the instrument. The results were presented in tables and graphs.

All procedures adhered to the ethical principles of research involving human subjects, ensuring confidentiality and voluntary participation.

III. Results and discussions

3.1. Results

A total of 24 valid questionnaires were obtained (96% of the census population; N = 25). The findings are presented below according to the general objective and the three specific objectives.

Overall Level of Musical Stage Anxiety

Table 1

Level of musical performance anxiety among students at an art school in Puno, 2025.

Musical performance	Frequency	Percentage (%)
Low	14	58.3
Moderate	10	41.7
High	0	0.0
Total	24	100

Source: Compiled from the instrument administered to students at an art school in Puno.

The findings show that 58.3% of the students present a low level of music performance anxiety, while 41.7% are at a moderate level, and no cases of high level were recorded. This pattern suggests that, in general terms, the evaluated population possesses relatively adequate coping resources in response to public performance situations.

The absence of high levels is a relevant indicator, as it suggests that there are no severe cases that critically compromise musical performance. However, the significant proportion of moderate levels indicates that nearly half of the students experience functional anxiety activation, which, although not incapacitating, could affect performance quality in high-demand situations such as recitals or public evaluations.

From an educational perspective, these results may be interpreted as a balance between adequate technical training and the presence of emotional factors inherent to the performance context.

Levels by K-MPAI Dimensions

Table 2

Influence of early life experiences on students at an art school in Puno, 2025.

Context of early	Frequency	Percentage (%)
Unsubscribe	1	4.2
Moderate	21	87.5
High	2	8.3
Total	24	100

Source: Compiled from the instrument administered to students at an art school in Puno.

In this dimension, 87.5% of the students are at a moderate level, followed by 8.3% at a high level and only 4.2% at a low level. This finding suggests that most participants have had intermediate musical experiences during their development, without either intense early exposure or a complete lack of performance training.

This predominance of the moderate level can be interpreted as an ambivalent factor: on one hand, it implies some familiarity with musical performance settings; on the other hand, it may indicate that not all students have developed sufficient early exposure to fully consolidate stage confidence.

Likewise, the small group with high levels may have been exposed to more demanding or structured environments from early stages, which could influence their greater sensitivity to the current evaluative context.

Table 3

Level of generalized psychological vulnerability among students at an art school in Puno, 2025.

Generalized		
Low	2	8.3
Moderate	22	91.7
High	0	0.0
Total	24	100

Source: Compiled from the instrument administered to students at an art school in Puno.

The results show that 91.7% of students present a moderate level of psychological vulnerability, while 8.3% are at a low level, and no high levels were reported. This is the most homogeneous dimension of all, indicating a shared general tendency within the studied group.

The predominance of the moderate level suggests the presence of intermediate psychological characteristics such as persistent worry, self-criticism, or situational insecurity, although not reaching severe clinical traits. This may be related to the demands of artistic training, where constant performance evaluation is a structural component of learning.

From an interpretative perspective, this dimension may function as a baseline factor influencing how students face performance situations.

Table 4

Level of performance anxiety among students at an art school in Puno, 2025.

Performance anxiety	Frequency	Percentage (%)
Low	6	25.0
Moderate	16	66.7
High	2	8.3
Total	24	100

Source: Compiled from the instrument administered to students at an art school in Puno.

In this dimension, 66.7% of students present a moderate level, 25% a low level, and only 8.3% a high level. Unlike the other dimensions, a greater dispersion of results is observed here, indicating variability in how students approach anticipation of musical performance.

The predominance of the moderate level suggests that most students experience anticipatory concern, which is common in artistic evaluation contexts. However, the

proportion with low levels indicates that a significant group of students manages performance anticipation effectively.

The small group with high levels coincides with the most sensitive cases identified in other dimensions, which may suggest a relationship between early experiences and greater performance-related concern.

Integrated global interpretation

Overall, the results show a profile characterized by predominantly low to moderate levels of music performance anxiety, with no significant presence of high levels. However, internal psychological dimensions (especially generalized psychological vulnerability) remain at moderately elevated levels, suggesting that performance anxiety is not expressed in a severe form, but there is a susceptible emotional base.

This indicates a possible dissociation between internal vulnerability and the behavioral manifestation of performance anxiety, which may be explained by factors such as academic adaptation, progressive musical training, or coping strategies developed during education.

From an educational perspective, these findings highlight the importance of implementing preventive strategies focused not only on musical technique but also on strengthening psychological skills such as emotional regulation, self-confidence, and coping with public evaluation.

3.2. Discussion

The results of this study reveal that tenth-semester students in the Art Education – Music program at an art high school in Puno exhibit a predominantly low to moderate profile of musical stage anxiety (58.3% low and 41.7% moderate; 0% high). This pattern indicates that, although some anxious arousal persists, the majority maintain functional emotional control that allows for adequate stage performance.

Compared to the literature, the levels found are notably lower than those reported by Arias and Cáceres (2021) in Peruvian students and by Barros et al. (2024) in Brazilian university students, who identified high prevalences of performance anxiety associated with perfectionism, excessive self-criticism, and a lack of emotional training. The difference could be explained by contextual factors specific to the institution studied in Puno: greater familiarity with recurring public performances, lower perceived evaluative pressure, or a more supportive institutional climate. Meanwhile, the findings partially align with Hallasi (2022), who also observed a predominance of moderate levels among students at the National University of San Agustín (Arequip). Both studies support the notion that musical stage anxiety in Peruvian contexts tends to manifest as a common but non-disabling phenomenon, capable of acting as a performance enhancer when it remains within moderate ranges.

From a theoretical perspective, the results align with the postulates of Kenny (2011) and the psychology of musical performance: performance anxiety is modulated by the interaction

between early experiences, general psychological vulnerability, and immediate concern about the performance. In this sample, the high prevalence of moderate levels across the three dimensions of the K-MPAI (66.7–91.7%) explains the low-to-moderate overall score, while the coincidence of the only two high-scoring cases in early experiences and performance-related concerns reinforces the predictive role of negative childhood and adolescent experiences.

IV. Conclusions

It was determined that musical stage anxiety among music education students at an art school in Puno, 2025, is mostly at a moderate level, indicating a controlled emotional response to performance, without significantly affecting their musical performance.

It was found that the influence of early experiences is predominantly moderate, indicating that initial musical experiences have had a balanced impact on students' confidence and coping with performance anxiety.

It was found that the level of generalized psychological vulnerability is mainly moderate, reflecting some emotional insecurity, though with sufficient capacity to handle stage pressure and maintain adequate performance.

It was found that performance anxiety is mostly at a moderate level, indicating normal tension in the face of public exposure, which can be channeled positively into musical performance.

Ethics Statement

I declare that this scientific article has been prepared by me based on the principles of academic integrity, honesty, and scientific responsibility. I commit that all the information used comes from reliable sources, which have been properly cited and acknowledged in the text. Furthermore, I affirm that this work is original and does not contain any plagiarism, falsified, or manipulated data. Finally, I declare that there are no conflicts of interest that have influenced the development of this study.

Acknowledgment

Gratitude is expressed to the educational institution where the study was conducted for facilitating access to the students and allowing the administration of the instrument. Likewise, appreciation is extended to the participants for their willingness to respond to the questionnaire responsibly. Recognition is also given to the teachers of ESFAP Puno, who provided knowledge that contributed to the academic and pedagogical preparation necessary for the development of this research. In particular, special thanks

are given to the advisor, M.A. Jorge Abel Paricahua Huaco, for his responsible guidance, relevant observations, and suggestions that helped properly consolidate this study. It is hereby stated that this research did not receive external funding and was developed using personal resources.

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Teaching Methodology Influence on Musical Learning Among Students at “Escuela Superior de Formación Artística Pública de Moho”, 2025

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ABSTRACT

The present study was conducted within the institutional context of the “Escuela Superior de Formación Artística Pública de Moho” during the 2025 academic year, aiming to examine musical learning in relation to the teaching methodologies employed by instructors. The primary objective was to determine the extent to which the instructional methodology influences students’ musical learning levels. From a methodological perspective, the research adopted a quantitative approach and was classified as an applied study with a correlational scope and a non-experimental, cross-sectional design. The study involved a sample of 50 students selected through probabilistic sampling techniques. Data collection instruments included a structured questionnaire and a musical performance assessment rubric designed to ensure the validity and reliability of the measurements. The findings revealed a moderate level of teaching methodology alongside a regular level of musical learning achievement, and statistical analysis indicated a strong positive correlation between the variables ($r = 0.71$), suggesting that more effective methodological implementation corresponds to higher musical learning levels. In conclusion, the results demonstrate the significant influence of the teaching methodology on musical learning, highlighting the need to strengthen didactic strategies, diversify pedagogical resources, and reinforce formative assessment practices to optimize students’ artistic and professional development.

Keywords: Attitudinal, cognitive, communicative, didactic, methodology, procedural.

I. Introduction

According to García (2019), cognitive factors such as motivation are decisive in musical learning; however, appropriate environmental conditions, infrastructure, and resources must be present. The lack of economic resources and the absence of faculty training in methodologies aligned with scientific advancement constitute significant

disadvantages. This research recommends prioritizing financial investment and implementing more suitable strategies and methodologies to enhance the teaching-learning process. According to González-Moreno (2013), motivation is fundamental for music students compared with those in other disciplines. The findings suggest that students engaged in musical studies exhibit higher levels of motivation. According to Zarza Alzugaray et al. (2016), despite efforts to emphasize integral education including music, students are often not adequately prepared to fully develop their artistic skills.

According to Sotelo Asipali (2019), there is a strong and significant correlation between stimulation and eloquent education; According to Púñez Lazo (2019), a longitudinal 14-year experiment in secondary and higher education demonstrated that motivation-based programs within a qualitative framework significantly favor learning. According to Medina Canal (2021), study habits are closely related to the academic performance. Improving these habits is essential for enhancing the quality of the educational system and academic outcomes. According to Peiteado (2013), pedagogical aspects are fundamental to the instructional procedure. Efficient practice involves reconciling different teaching styles with diverse learning forms, requiring educators to master various approaches to reach students. According to Diaz la Rosa (2014), the educational system must be grounded in principles to achieve outstanding results. The study concluded that reciprocity exists between values and morality; teachers with sound ethical standards demonstrate effective performance.

According to Gutiérrez Lapa & Peña Almidón (2018), virtual classrooms influence the educational process favorably, serving as a support tool for face-to-face studies and improving the quality of professional training. According to Cutipa Chávez (2024), infrastructure limitations at the ESFAP Francisco Laso in Tacna hinder the academic and artistic development of first-year music students.

According to Ginocchio Castro (2017), evaluating educational subjects in higher education presents challenges and objectives specific to the arts, concluding that such assessment is vital within arts pedagogy. According to Rincon Sierra (2020), the application of Jerome Bruner's cognitive theory through ludic games in music education yields positive results in reinforcing environmental behavior and educational action; According to Osorio Osorio (2018), meaningful learning is linked to specific study habits; the integration of these components during instruction positively affects skill development.

According to Segovia Quin (2014), organizational wisdom and institutional mission are closely linked to institutional management, ensuring the educational process remains significant. According to Borda & Paola (2019), critical thinking is a faculty developed by students through specific didactic strategies. The study concludes that critical thinking is a progressive and transformative force when fostered through strategic design. According to Gonzalez Aranda (2018), the professionalization of music and art in Peru is less developed than in other countries, often being relegated to

a "hobby." Inadequate infrastructure further complicates educational efforts. According to Pisconte Tipismana (2021), there is a significant link between multiple intelligences, emotional intelligence, study habits, and overall educational efficiency.

According to Coronado Flores (2021), low compatibility with Andean cultural identity among students hinders the educational process and the acquisition of learning. According to Reyes Sánchez (2016), didactic methods in the instructional system are related to relevant learning, specifically regarding the teaching of music theory and score reading. According to Leyva Capcha & Sebastian Marchan (2024), musical training facilitates oral language development, mental stimulation, and concentration. According to Flores Asqui (2019), imprecise educational policies and curricular plans result in didactic guidelines that fail to foster student creativity. This research advocates for critical thinking through methods such as those by Zoltan Kodály and Jacques Dalcroze. According to Cariapaza Condori (2019), there is a correlation between the use of the internet as a pedagogical tool and knowledge acquired through traditional methods within the teaching-learning process.

According to Llanga Vargas & Insuasti Cárdenas (2019), music significantly influences both academic situations and daily life. The study confirmed increased brain motivation during music perception, which enhances cognitive functions and information retention. According to Porta. Navarro (1998), the auditory factor in cinema is a fundamental communication element; therefore, music didactics within this communicative segment is essential for student educational purposes. According to Martínez (2016), simulation games serve as effective pedagogical tools. Students who manage adverse emotional shifts through emotional intelligence achieve consistent academic performance.

II. Methodology

Research Type

The study employs a quantitative approach, as numerical data were collected to measure the relationship between teaching methodology and musical learning levels among students. Furthermore, it is classified as applied research, since it seeks to generate knowledge aimed at enhancing pedagogical processes within musical training.

Research Level

The study is correlational, as it analyzes the relationship between two variables:

Independent Variable: Teaching methodology

Dependent Variable: Musical learning level

The purpose was to determine the degree of influence exerted by the methodology applied by instructors on the students' musical learning.

Research Design

The study employed a non-experimental, cross-sectional correlational design. It was non-experimental because the variables were not manipulated but observed in their natural context. It was cross-sectional because data were collected at a single point in time during the 2025 academic year. Additionally, it was correlational because it enabled the identification of the relationship between the studied variables.

Population and Sample

Population. The population consisted of 150 students enrolled in the institution during the 2025 academic year.

Sample. The sample comprised 50 students selected through simple random sampling, ensuring that all students had an equal chance of selection and that representativeness was guaranteed.

Data Collection Techniques and Instruments

Techniques. The following techniques were used to obtain data. A survey was administered to collect information regarding students' perceptions of the teaching methodology applied by instructors. In addition, a musical performance evaluation was conducted to measure the level of musical learning attained by the students.

Instruments. The instruments included a structured questionnaire, developed with closed-ended questions based on a Likert scale to evaluate teaching methodology, and a musical evaluation rubric, designed to measure musical skills such as performance, music reading, rhythm, and instrumental technique. Both instruments were validated through expert judgment, and their reliability was verified using Cronbach's alpha coefficient.

Research Procedure

Authorization was obtained from institutional authorities; the student sample was selected; the instruments were validated by specialists in music education; the questionnaires and musical evaluations were administered; the collected data were organized and systematized; statistical analysis was performed; and the data were interpreted to formulate conclusions.

III. Result and Discussions

3.1. Results

The data obtained from the study conducted with 50 students showed the distribution of levels across the variables examined. Regarding teaching methodology, a medium level predominated in the dimensions of didactic strategies, pedagogical resources, and formative evaluation. With respect to musical learning, the results indicated a higher

concentration at the intermediate level in musical performance, music reading, and instrumental technique. Statistical analysis using Pearson's correlation coefficient yielded a value of $r = 0.71$, indicating a strong positive relationship between teaching methodology and musical learning.

3.1.1. Implementation Level of the Teaching Methodology

Table 1

Level of Implementation of Teaching Methodology

Dimensions	Low	Medium	High	Total
Didactic strategies	9	26	15	50
Pedagogical resources	11	24	15	50
Formative evaluation	10	25	15	50

Note. Results obtained from the questionnaire administered to the students.

The data demonstrated that the highest frequency was concentrated at the medium level across the three evaluated dimensions.

3.1.2. Musical Learning Level

Table 2

Students's Musical Learning Level

Dimensions	Deficient	Regular	Good	Total
Musical performance	8	27	15	50
Music reading	10	25	15	50
Instrumental technique	9	26	15	50

Note. Results obtained through the musical evaluation rubric administered to the students.

The results evidenced a higher frequency at the regular level across the evaluated dimensions.

3.1.3. Relationship between Teaching Methodology and Musical Learning

Table 3

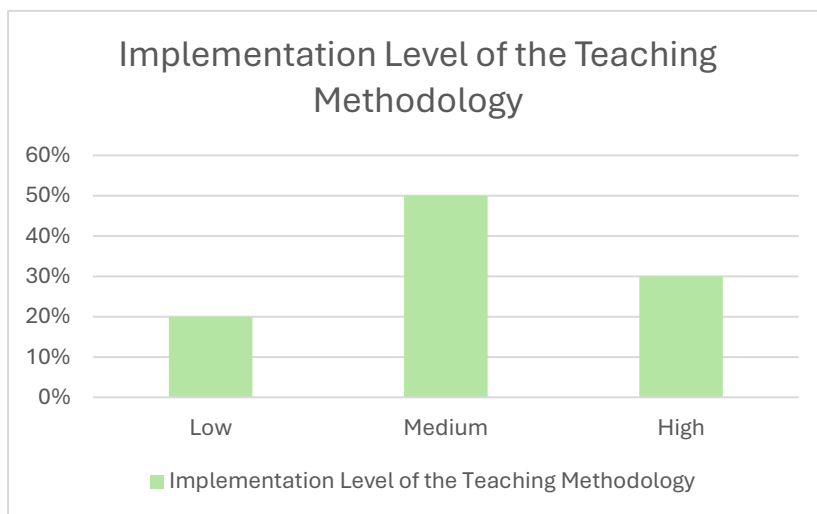
Correlation between Teaching Methodology and Musical Learning

Variables	Teaching methodology	Musical Learning
Teaching methodology	1	0.71
Musical learning	0.71	1

Note. The Pearson correlation coefficient showed a value of $r = 0.71$.

Figure 1

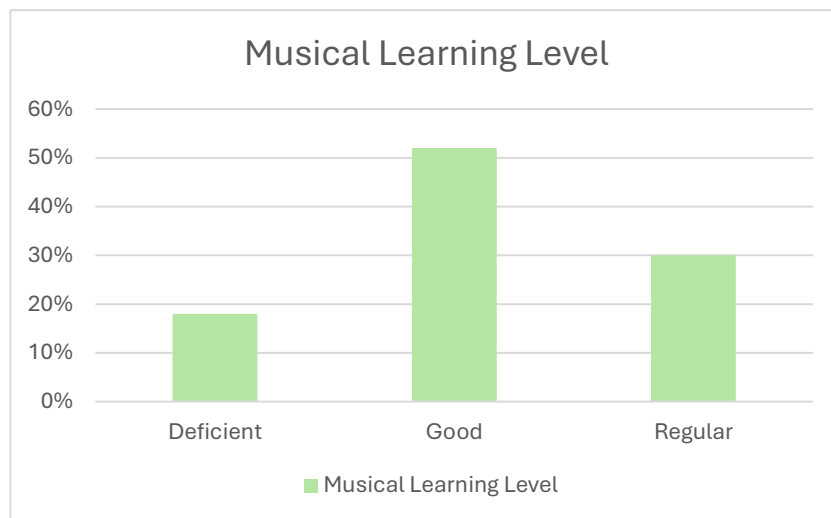
Implementation Level of the Teaching Methodology



Note. The bar chart demonstrated that the medium level exhibited the greatest predominance in the perception of the teaching methodology.

Figure 2

Musical Learning Level



Note. The bar chart evidenced a predominance of the regular level in the musical learning of the evaluated students.

3.2. Discussion

The results of the present study demonstrate that teaching methodology plays a decisive role in students' musical learning, as evidenced by the predominance of a medium level of methodological implementation and a regular level of musical learning across the evaluated dimensions. The strong positive correlation identified between these variables ($r = 0.71$) confirms that more systematic and diversified pedagogical practices are associated with higher levels of musical proficiency.

These findings are consistent with the theoretical perspectives previously cited. In particular, the results align with García (2019), who emphasizes the importance of cognitive factors such as motivation and the provision of adequate educational conditions for effective musical learning. Similarly, the predominance of a regular level of musical achievement supports the assertions of Zarza Alzugaray et al. (2016), who note that students are often insufficiently prepared to fully develop their artistic skills despite institutional efforts toward integral education.

The positive relationship between teaching methodology and learning outcomes also corroborates the work of Peiteado (2013), who highlights the necessity of reconciling diverse teaching styles with varied learning forms to effectively reach students. Furthermore, the findings agree with Reyes Sánchez (2016), who establishes a link between didactic methods and meaningful learning in music theory and score reading.

The importance of formative and motivational elements observed in this study is likewise supported by González-Moreno (2013) and Púñez Lazo (2019), whose research underscores the fundamental role of motivation and structured pedagogical programs in enhancing educational outcomes. Additionally, the need to strengthen pedagogical processes identified in this research resonates with the conclusions of Flores Asqui (2019), who advocates for the implementation of innovative didactic strategies—such as those proposed by Kodály and Dalcroze—to foster student creativity and engagement. In this context, the present study contributes empirical evidence to the existing body of knowledge by confirming that the effectiveness of musical education depends not only on instructors' technical expertise but also on their capacity to implement coherent, student-centered methodologies supported by adequate resources and continuous formative assessment. Overall, these findings reinforce the theoretical proposition that the integration of motivational, cognitive, and pedagogical dimensions is essential for achieving meaningful and sustained musical learning within higher artistic education.

IV. Conclusions

The findings of this study confirm the existence of a significant positive relationship between teaching methodology and musical learning among students of the Moho Public Higher School of Artistic Training. The Pearson correlation coefficient ($r = 0.71$) demonstrates that more systematic and diversified pedagogical practices are associated with higher levels of musical proficiency, thereby highlighting the decisive role of instructional methodology in artistic education.

The analysis revealed that teaching methodology was predominantly implemented at a medium level, indicating that instructors apply didactic strategies, pedagogical resources, and formative assessment processes in a partial yet functional manner. This outcome underscores the need to strengthen pedagogical planning and methodological coherence to enhance educational effectiveness. These results are consistent with the theoretical perspectives of Peiteado (2013) and Reyes Sánchez (2016), who emphasize that the integration of diverse teaching strategies is essential for fostering meaningful learning in music education.

Furthermore, students' musical learning was primarily situated at a regular level across the dimensions of musical performance, music reading, and instrumental technique. This finding suggests that, although students develop fundamental competencies, they do not consistently achieve optimal levels of technical and expressive mastery. Such results align with the assertions of Zarza Alzugaray et al. (2016), who note that students are often insufficiently prepared to fully realize their artistic potential despite institutional educational efforts.

The study also highlights the importance of motivational and cognitive factors in the teaching-learning process. The positive association between methodological

implementation and learning outcomes supports the contributions of García (2019), González-Moreno (2013), and Púñez Lazo (2019), who underline the central role of motivation and structured pedagogical programs in enhancing educational achievement. Consequently, strengthening teaching methodology through innovative and student-centered approaches—such as those inspired by the pedagogical models of Kodály and Dalcroze, as suggested by Flores Asqui (2019)—is essential for promoting deeper and more meaningful musical learning.

In general terms, this research provides empirical evidence that effective musical education depends not only on instructors' technical expertise but also on their capacity to design and implement coherent, participatory, and contextually relevant pedagogical strategies. Therefore, it is recommended that higher artistic education institutions promote continuous professional development for instructors, diversify didactic resources, and reinforce formative assessment practices to optimize students' artistic and professional development.

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Costume Symbolism in the Wapululos Dance, District of Lampa – Puno, 2025

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ABSTRACT

This research addresses the Carnival of Wapululos dance from the district of Lampa, Puno, which is distinguished by its rich folklore and its potential to revalue and disseminate its native expressions. The Wapululos dance is one of the most representative during the Carnival Chico and Carnival Grande, celebrated annually in the province of Lampa. The objective of this study is to analyze the symbolism of the costume used in this cultural manifestation. An ethnographic and descriptive methodology was applied under a qualitative approach, considering as the study population participants and knowledgeable individuals historically linked to the dance. The sampling was non-probabilistic, and observation and structured questionnaire techniques were employed in order to understand and highlight the symbolic meaning of the garments used. The results show that the dance conveys values, traditions, and the identity of the people of Lampa, integrating music, choreography, and costume with nature. Likewise, the response “Yes” predominates in most questions, with P6 and P8 reaching 100% acceptance, while in P12 the response “No” predominates (60%). Overall, a favorable evaluation of the costume as a symbolic element of the dance is observed. In conclusion, the research demonstrates that the costume of the Carnival of Wapululos dance is a symbolic medium that reflects the identity, history, and worldview of the people of Lampa. Each garment expresses values linked to tradition and community life, strengthening the sense of belonging. Therefore, the importance of preserving and transmitting this manifestation as a living heritage of the Puno region is emphasized.

Keywords: Carnival, costume, culture, dance, symbolism.

I. Introduction

Cultural heritage, according to Morales (2021), reveals the lack of a systematized record of the clothing used in performing arts, rituals, and festive celebrations in the Peruvian context. Loma (2022) indicates that culture constitutes an accumulative process of knowledge, including scientific understanding, technological advances, philosophical thought, modes of behavior, and moral and civic values, emerging from intergenerational interaction among human beings and between them and their natural environment. This system must provide each individual with the opportunity to participate creatively in all expressions of human life Leontiev (2013). These shared and socially learned experiences are what we call culture (Geertz, 1973).

Jullien (2017) notes that the search for and affirmation of cultural identity has become a global trend, both as a response to the resurgence of nationalisms and to the effects of globalization. It represents a connection to a specific culture, developed throughout life through the appropriation and internalization of cultural traits shared by a group, allowing individuals to establish differences in their interactions with others (Rivera, 2008).

Machicado (2010) states that custom constitutes an early manifestation of customary law, understood as the continuous repetition of a practice that, over time, acquires an obligatory character. Thompson (2019), in his book *Customs in Common*, provides a detailed analysis of English popular culture between the 17th and 19th centuries, showing how rituals, community practices, and social norms functioned as mechanisms that strengthened group cohesion, while also serving as forms of resistance to economic and political changes.

Portugal (2015), in his work *Dances and Dances of the Altiplano*, points out that various legends mention the Lupaqas or “sun men,” the Uros or “men of the day,” and the Chullpas or “giant men” as the first inhabitants of the Titicaca Altiplano. Around the world, people dance for different reasons and in different ways; therefore, dance can be defined as the expression of the human spirit through body movement (Hernández, 2022).

Over time and with the emergence of diverse dance styles, the meaning of the term evolved to be understood as the artistic creation or composition of a dance piece (Ochoa, 2014). Study is not a spontaneous activity; it always requires a particular effort of concentration (Garcés, 2021).

The city of Lampa is located in the central and western zone of the department of Puno, at coordinates 15° 21'54'' south latitude and 70° 22'03'' west longitude with respect to the Greenwich meridian (Salazar, 2017). The Carnival of Lampa, also known as *puqllanchay* or *pukllay* (game) in Quechua, constitutes the festive context in which the *Wapululo* dance is performed. The term “wapu” refers to bravery and beauty, while “lulu” or “luli” refers to youth, women, or a hummingbird (Valdez, 2022).

Its essence lies in bodily movements articulated in relation to time and space, guided by the rhythm and melodies of music (Loma, 2022). Accents, pulses, and metric structure play a fundamental role due to the way they articulate different elements, implying that the body has a decisive role in the learning of musical rhythm (Herrera, 2012).

According to Cross (2010), when approaching music from evolutionary perspectives, it is essential to have a clear and broad definition of what is meant by “music.” This musical imitation, distinct from verbal imitation characteristic of poetry, would be equally authentic and even more direct and natural (Millet, 2000).

Espinosa (2013) argues that clothing, in addition to fulfilling the basic function of protecting the human body, acquires in the Andean context a role of symbolic representation of cultural, social, and religious ideas. According to Bueno (2013), clothing constitutes a fundamental component of dance, understood as that which covers and protects the body.

From this perspective, human beings have developed a symbolic capacity based on the creation of meanings, understanding that these arise through the production and interpretation of signs (Zavala, 2017). Barbeta (2015), from the perspective of social sciences and anthropology, argues that the theory of symbolism and meaning is closely linked to the social practices carried out by individuals in their daily lives.

Douglas (2023), in her book *Natural Symbols*, develops a comprehensive theory on how people interpret their relationship with society and construct their own system of values. Bruce (1997) states that a sign is any object or idea that refers to or indicates another reality, either directly or indirectly. For this reason, it is essential to recognize the semiotic dimension of dance, understood as the creation of meaning comparable to any form of discourse (Toro y Lopez, 2018).

Gómez y Flores (1996) state that qualitative research analyzes phenomena within their own context, observing them as they develop and seeking to understand them based on the meanings they acquire for participants. Villafame (2015) explains that the qualitative approach is based on non-standardized data collection methods, avoiding numerical measurement of subjective or intersubjective phenomena.

The descriptive method aims to achieve a preliminary understanding of reality through direct observation by the researcher and the analysis of information provided by other authors (Abreu, 2014). In general terms, observation is a systematic procedure that allows the visual and verifiable recording of the facts to be studied (Campos y Martínez, 2012).

II. Methodology

This research is conducted under a qualitative approach, of an ethnographic and descriptive type, aimed at analyzing the symbolism of the costumes used in the Carnival

of Wapululos dance in the district of Lampa, Puno. This approach allows for an understanding of cultural reality from the perspective of the social actors themselves, considering their experiences, knowledge, and practices related to the dance.

The study population consists of dance participants and knowledgeable individuals who maintain a historical connection with its development. The sampling is non-probabilistic, selecting key informants based on their experience, knowledge, and participation in the cultural manifestation. Data collection techniques include direct observation and a structured questionnaire. Observation allows for the detailed recording of costume elements in their real context of use, as well as their relationship with choreography and music. The structured questionnaire, in turn, facilitates the collection of specific information regarding the symbolic meanings attributed to each garment by the involved actors.

The processing and analysis of the information are carried out through qualitative interpretation, organizing the data into categories related to symbolism, cultural identity, tradition, and local worldview. In this way, a comprehensive understanding of the costume is achieved as a representative element of the culture of the people of Lampa, in accordance with the objectives established in the research.

III. Results and Discussion

3.1. Results

The results indicate that the costume of the Carnival of Wapululos dance is a symbolic medium that expresses the identity and tradition of the people of Lampa, beyond its aesthetic function. Its continuity is due to intergenerational transmission, which strengthens the sense of belonging and highlights the importance of its preservation as a living cultural heritage.

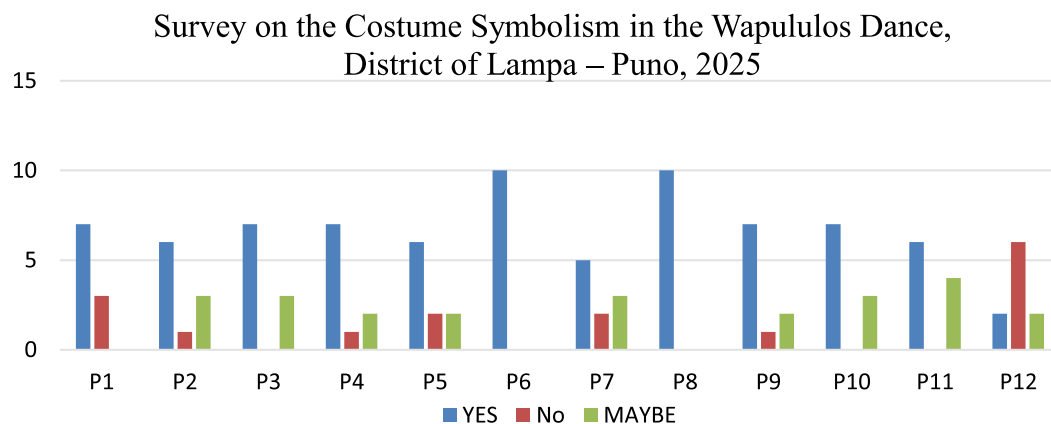
Table 1

Total, number of respondents (12 people) regarding the symbolism of the costume of the Carnival of Wapululos dance in the district of Lampa

Level	Frequency	Percentage
Yes	80	66.7%
No	16	13.3%
Maybe	24	20.0%
Total	120	100%

Note: Questionnaire applied to the inhabitants of the district of Lampa, 2025.

Figure 1



Note. Total number of respondents (12 people) regarding the “Costume Symbolism in the Wapululos Dance, District of Lampa

The results by question show a predominance of “Yes” responses across most items, with questions P6 and P8 standing out with 100% agreement. However, in question P12, the response “No” predominates with 60%, indicating a different perception regarding that specific aspect. Overall, a favorable trend is observed toward the recognition of costume as a symbolic element within the dance.

G.O.: To analyze the symbolism of the costume of the Carnival of Wapululos dance in the district of Lampa

The results show that each garment of the women’s costume carries a symbolic meaning linked to identity, fertility, tradition, and community belonging. This chapter presents the findings obtained through observation, interviews, and photographic records, following a qualitative and ethnographic approach. The results are organized into categories related to women’s and men’s costumes, as well as their traditional and contemporary variations. These contributions help to understand the symbolism and identity of the Carnival of Wapululos and strengthen the appreciation of the cultural heritage of Lampa and its educational application.

Symbolism of each item of women's clothing

Montera: The montera is a traditional Andean women’s hat that represents identity and cultural origin. It is handcrafted and symbolizes respect, spirituality, and a connection with Pachamama.

Jacket: The women’s jacket of the Carnival of Wapululos covers from the neck to the waist and combines colors such as blue, red, and black, carrying strong cultural meaning. It is handmade from wool or bayeta cloth and stands out for its embroidery

of birds, flowers, and Andean elements. These designs express the Andean worldview, the relationship with nature, and symbolize joy, tradition, and the cultural identity of the people of Lampa.

Phuyo: The phuyo is a small white shawl worn on the back by women, used as protection against the cold and as a symbol of territorial identity. It is handcrafted from sheep wool using traditional techniques. Its colors and embroidery represent the relationship with nature and reinforce its cultural value in the Carnival of Wapululos dance.

Llijlla (Awayo): The llijlla, also called awayo or phitay, is a colorful textile worn on the back during the Carnival of Wapululos. It is made on a traditional loom using wool and natural dyes, characterized by geometric designs. It symbolizes fertility, energy, and identity, representing the memory and cultural continuity of Andean women.

Pollera (Skirt): The polleras used in the Carnival of Wapululos are wide skirts made of black bayeta, with fine pleats and satin ribbons that enhance the movement of the dance. They are handcrafted and combine colors such as red and blue, which symbolize vitality and protection. Together, they represent identity, rhythm, and the Andean worldview.

Underskirts: The huqunchas are wide and lightweight textiles that accompany the movement of the dance.

- **Yellow:** symbolizes vitality, joy, and agricultural prosperity.
- **Red:** represents strength, energy, and feminine protection.
- **Green:** expresses fertility, the Andean landscape, and connection with Pachamama.
- **Pink:** reflects tenderness, sensitivity, and youthful joy.

Together, each color contributes a symbolic meaning within the costume and cultural identity of the Wapululo woman.

Huaracas or Wichi Wichis: The huaracas or wichi wichis are ceremonial slings made from llama fiber, decorated with pom-poms and a small basket with fruit. They accompany the dance, adding rhythm. They are handcrafted using traditional techniques and symbolize protection, feminine authority, fertility, and a connection with nature within the Carnival of Wapululos.

Ojota (Sandals): The traditional footwear is light and flexible, with crossed straps and colorful details that accompany the dance. It is handcrafted from leather with durable finishes. It symbolizes the connection with the earth, Andean resilience, and the festive identity of the community.

Figure 2

Women's Costume: Red Satin and Blue Satin



Symbolism of each item of men's clothing

Hat: A black, high-crowned hat with a wide brim, made of sheep wool and decorated with ribbons and festive ornaments. It is handcrafted through felting and manual shaping. It symbolizes authority and leadership, while its decorative elements reflect the joy of the Carnival of Wapululos.

Almilla: The almilla, similar to a shirt without a front opening, is woven from white sheep or alpaca wool to provide warmth during the dance. It is made using traditional techniques and features a reinforced collar and fitted cuffs. The white color symbolizes purity, integrity, and peace within the ritual costume.

Trousers: The trousers, which cover from the waist to the ankles, are made of wool or alpaca bayeta, ensuring durability and comfort. They are crafted using traditional techniques and fastened with a button at the waist. Their color symbolizes purity, simplicity, and balance, representing the male figure as stable and respectful within the Carnival of Wapululos.

Llijlla (Awayo): The men's llijlla is a rectangular textile worn on the back, featuring geometric designs and symmetrically arranged birds in sober or contrasting colors. It is produced on a traditional loom using wool or alpaca and inherited techniques. It symbolizes identity, guidance, and protection; its motifs represent balance and spiritual

connection, while its festive tying reinforces the idea of abundance and reciprocity in the Carnival of Wapululos.

Belt (Faja): The faja is a textile belt used by men to secure trousers and skirts, as well as to provide lumbar support. It is handcrafted from woven wool using a loom and features colorful designs inspired by nature. It symbolizes fertility, agricultural labor, and cultural identity, reflecting the continuity of traditional knowledge.

Sling (Honda / Waraka): The honda or waraka is a festive implement carried by male dancers, made from braided llama or alpaca fiber cord, decorated with colorful rosettes and a horsehair tip that produces a sharp sound when swung. It symbolizes protection, vigor, and masculine skill; its colors represent festivity and abundance, and its cracking sound reinforces the ritual and dramatic character of the dance.

Ojota (Sandals): The ojota is a traditional rubber footwear, resistant and functional, used by men during the Carnival of Wapululos. It is made from recycled materials and assembled manually. It symbolizes simplicity, labor, self-sufficiency, and peasant identity linked to the agricultural world.

Figura 3

Men's Costume



3.2. Discussion

Dance, as an expression of the human spirit through body movement (Hernández, 2022), acquires a deep cultural meaning in the Altiplano, linked to historical memory. According to Portugal (2015), legends about the first inhabitants reinforce this

symbolic heritage, which is expressed in the Carnival of Lampa or puqllanchay, where the Wapululos dance reflects values such as bravery, beauty, and youth (Valdez, 2022). Its evolution as an artistic creation (Ochoa, 2014) also implies a conscious learning process (Garcés, 2021).

The discussion, based on testimonies of tradition bearers, shows that the costume functions as a symbolic system that conveys identity, memory, and the Andean worldview. In women's attire, the polleras or huqunchas and the llijlla reflect the connection with nature: yellow symbolizes fertility, green represents the rainy season, and red expresses energy and feminine strength, fulfilling both social and spiritual roles.

In men's attire, vigor and peasant heritage are highlighted. The bayeta represents labor and cultural resilience; the waraka symbolizes defense and fertility; and the llijlla with bird motifs represents guidance and protection. Overall, the costume acts as a visual language that preserves the cultural identity of Lampa and ensures the continuity of its traditions.

IV. Conclusions

The symbolism of the costume of the Carnival of Wapululos constitutes a cultural system linked to the Andean worldview. Each garment conveys memory, identity, and a connection with nature, functioning as a symbolic language that expresses social roles and spiritual relationships. The women's costume symbolizes fertility, harmony with nature, and inner strength. The huqunchas represent life cycles through color, the llijlla expresses protection and belonging, and the embroidery reflects the landscape and Andean balance. The men's costume represents energy, leadership, and spiritual connection. Silk provides dynamism, bayeta refers to peasant tradition, and the waraka and llijlla with bird motifs symbolize protection and guidance within the dance.

Ethical Statement

This research complies with the ethical requirements established for the development of academic studies. Throughout the research process, the principles of respect, responsibility, transparency, and scientific integrity were upheld. In addition, informed consent from participants was ensured, safeguarding their identity when necessary and guaranteeing the appropriate use of the information provided.

The study was conducted with respect for the cultural rights of the bearers of the Carnival of Wapululos tradition, avoiding any form of misrepresentation or misappropriation of their knowledge, and promoting an approach focused on the appreciation and recognition of their cultural heritage.

Acknowledgments

I am grateful to God for guiding and strengthening me throughout this academic process. I extend my appreciation to the Universidad Nacional del Altiplano, particularly the postgraduate program of the Master's degree in the Faculty of Social Sciences, with a specialization in Art and Art Education, and to my English teacher for the training received. I also thank my professors for their guidance and constant support.

I am especially grateful to my parents for their love and unconditional support. I also thank the tradition bearers and the inhabitants of Lampa for sharing their knowledge. Finally, I express my sincere gratitude to all those who contributed to the completion of this research.

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Cell Phone Use and the Musical Learning Process in Students of the School Band at Pedro Vilcapaza Secondary School, Azángaro, Puno, 2026

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ABSTRACT

The use of mobile devices has gained significant presence in contemporary educational contexts, creating new possibilities and challenges in teaching and learning processes. In the field of music education, the cell phone can function as a support tool for instrumental practice, access to audiovisual resources, and autonomous learning; however, it can also become a source of distraction. Within this framework, the present research aimed to analyze the influence of cell phone use on the musical learning process of students in the school band of Pedro Vilcapaza Secondary School, Azángaro, Puno, during the year 2026. The study was conducted under a quantitative approach, with a non-experimental cross-sectional design. The sample consisted of 50 students, to whom a 20-item Likert-scale questionnaire was applied. Data were processed using SPSS and organized into frequency and percentage tables. The results showed that cell phone use has a relevant influence on students' attention, participation, and musical practice, showing positive contributions when its use is oriented toward learning and unfavorable effects when it interferes with concentration. In the current educational context, cell phone use has become a common practice among students. The results show that 45% have a high level of cell phone use, 35% a medium level, and 20% a low level. Likewise, it is observed that 48% have a high level of musical practice. In attention: 40% high, 38% medium, and 22% low. These data show the influence of cell phones on musical learning. It is concluded that the cell phone constitutes a potentially useful pedagogical resource in musical learning, provided that its use is properly guided.

Keywords: attention, artistic education, cell phone, musical learning, participation.

I. Introduction

The advancement of information and communication technologies has generated important transformations in contemporary educational processes, modifying both forms of access to knowledge and teaching and learning strategies. In this context, the use of cell phones has become a common practice among students, not only for communication purposes but also for academic and educational activities (Cabero, 2020). Likewise, UNESCO (2019) states that mobile devices have expanded learning opportunities, especially due to their accessibility, portability, and versatility in different educational contexts.

Currently, the cell phone is part of the daily life of children, adolescents, and young people, which has led to new ways of interacting with information and educational resources. According to Prensky (2001), new generations function naturally in digital environments, which is why technological integration in education has become increasingly necessary. In the same line, Traxler (2018) argues that mobile learning has opened possibilities for more flexible, immediate, and personalized training.

Various studies have shown that cell phone use in education can have both positive and negative effects. On the one hand, Kukulska-Hulme (2012) notes that mobile devices facilitate immediate access to information, multimedia content, and learning support applications. Similarly, Ally (2009) argues that mobile learning promotes more dynamic educational experiences adapted to students' needs. Likewise, Crompton (2013) points out that technological mobility facilitates learning in different spaces and moments, extending the educational experience beyond the traditional classroom.

However, it has also been warned that inappropriate cell phone use can become a distracting element. Rosen et al. (2013) found that constant use of media and technology can affect students' concentration during academic activities. Similarly, Junco (2012) indicates that continuous exposure to digital interactions can reduce effective study time and affect academic performance. In the same sense, Carrier et al. (2015) argue that media multitasking interferes with sustained attention and the ability to process information.

Attention is an essential component of the educational process, since it allows students to select, organize, and process relevant information for learning. Lepp et al. (2015) state that excessive cell phone use can affect academic attention, especially when there is a high dependence on the device. Likewise, Chen and Yan (2016) warn that unregulated cell phone use can interfere with the proper development of cognitive and academic activities.

Another important aspect is student participation in their learning process. Gikas and Grant (2013) point out that mobile devices can promote interaction, communication, and participation in educational environments, as long as their use is linked to pedagogical activities. In turn, Sung et al. (2016) highlight that mobile technologies

can improve student engagement when integrated with a clear didactic purpose. Consequently, the impact of the cell phone largely depends on the purpose for which it is used.

In the field of musical learning, the incorporation of technological resources has gained special relevance. Hallam (2010) argues that contemporary music education benefits from the use of technological tools that facilitate listening, observation, repetition, and practice. Likewise, Bauer (2014) highlights that technology contributes to enriching music teaching processes by allowing access to applications, recordings, digital scores, and interactive resources.

Musical learning involves a complex process that articulates cognitive, motor, perceptual, and emotional dimensions. Levitin (2006) states that music involves brain processes linked to auditory perception, memory, coordination, and interpretation. Likewise, Hallam (2015) indicates that musical learning requires constant practice, concentration, and active participation, especially in instrumental training processes.

Musical practice constitutes one of the central elements in the development of musical skills. McPherson and Renwick (2011) argue that instrumental improvement depends largely on consistency, discipline, and autonomous practice. From this perspective, Dorfman (2013) states that technology can strengthen musical practice when it offers tools for repetition, self-evaluation, and monitoring student performance.

In recent years, the cell phone has begun to play an important role in music education. Biasutti (2015) points out that technology applied to music facilitates access to learning resources such as tutorials, videos, recordings, and digital accompaniments. Likewise, Ruthmann and Mantie (2017) emphasize that technological tools expand opportunities for musical learning both inside and outside the school environment. In the same line, Webster (2011) underlines that technology can increase student motivation in the music training process.

The use of cell phones can also strengthen student autonomy in musical learning. Kearney et al. (2012) propose that mobile learning promotes independence, flexibility, and self-regulation of learning. In turn, Wise et al. (2011) indicate that technology can foster more personalized musical practice processes, adapted to each student's pace and needs.

Nevertheless, the use of cell phones in musical training spaces may also present limitations. Samaha and Hawi (2016) point out that excessive smartphone use can generate dependency and affect academic commitment. Similarly, Vázquez-Cano (2014) warns that the integration of cell phones in education must be pedagogically oriented to avoid unproductive uses. In this regard, Area (2010) argues that the incorporation of technology is only meaningful when it responds to clear educational objectives.

From a pedagogical perspective, technology should not be understood solely as an instrumental resource, but as a tool that can transform the learning experience. Mayer (2009) explains that meaningful learning improves when students interact with multimodal materials in an organized way. In the case of music, this is particularly relevant, since learning is usually supported by sound, visual, and practical resources.

In the Peruvian school context, especially in institutions where school bands exist, the cell phone can play a dual role. On the one hand, it can facilitate access to exercises, repertoires, reference audios, and individual practice; on the other hand, it can interfere with attention and participation during rehearsals or training sessions. This situation becomes particularly important in contexts where musical learning requires discipline, attentive listening, group coordination, and consistent practice.

At Pedro Vilcapaza Secondary School, located in Azángaro, Puno, it was observed that students who are members of the school band frequently use cell phones during their training process. This reality creates the need to understand how such use influences their musical learning, especially in dimensions such as attention, participation, and instrumental practice.

Within this framework, the present study aimed to analyze the influence of cell phone use on the musical learning process of students in the school band of Pedro Vilcapaza Secondary School, Azángaro, Puno, during the year 2026.

II. Methodology

The research was conducted under a quantitative approach, since it allowed the collection, organization, and analysis of numerical data related to cell phone use and the musical learning process among students. This approach facilitated the description of behaviors, perceptions, and levels of incidence observed in the study population.

The study corresponded to a non-experimental cross-sectional design, given that the variables were observed in their natural context, without direct manipulation by the researcher and at a single point in time. This design made it possible to examine the situation of cell phone use and its relationship with musical learning within the real context in which the students develop.

The population and sample consisted of 50 students who were members of the school band of Pedro Vilcapaza Secondary School, Azángaro, Puno. Due to the accessible size of the group, all available participants were included in the data collection process.

The technique used was the survey, as it was considered appropriate for obtaining direct information about students' perceptions and practices regarding cell phone use and their musical learning. As an instrument, a structured 20-item questionnaire was used, designed based on the study variables and organized on a Likert-type scale.

The questionnaire was designed to collect information on the variable cell phone use and its relationship with aspects of musical learning, particularly in dimensions such as attention, participation, and musical practice. The items were written according to observable situations within the training context of the school band.

Regarding the procedure, the instrument was administered in coordination with the educational institution, respecting the organizational conditions of the school environment. Subsequently, the data were systematized and processed using the SPSS program, mainly employing descriptive statistics through frequencies and percentages to organize and interpret the information obtained.

III. Results and Discussion

3.1. Results

The main findings obtained from the application of the questionnaire to the 50 students who participated in the study are presented below. The results were organized considering the variable of cell phone use and the dimensions associated with the musical learning process.

Cell phone use (45% high) shows a significant presence among students. Attention levels exhibit variability, indicating potential distractions. Participation shows acceptable levels, although there is room for improvement. Musical practice (48% high) highlights the positive impact of the cell phone as a supportive tool.

Table 1

Influence of Cell Phone Use on Musical Learning

Variables	High	Medium	Low
Cell phone use	45%	35%	20%
Attention	40%	38%	22%
Participation	42%	36%	22%
Musical practice	48%	30%	22%

Note. Data obtained through the application of the questionnaire to students in the school band of Pedro Vilcapaza Secondary School.

The results showed that 45% of the students presented a high level of cell phone use, while 35% showed a medium level and 20% a low level. These data indicate that the cell phone forms an important part of the students' daily experience in their training context.

Regarding the attention dimension, 40% of the participants were located at the high level, 38% at the medium level, and 22% at the low level. These results suggest that students' attention during the musical learning process presents variable levels, which

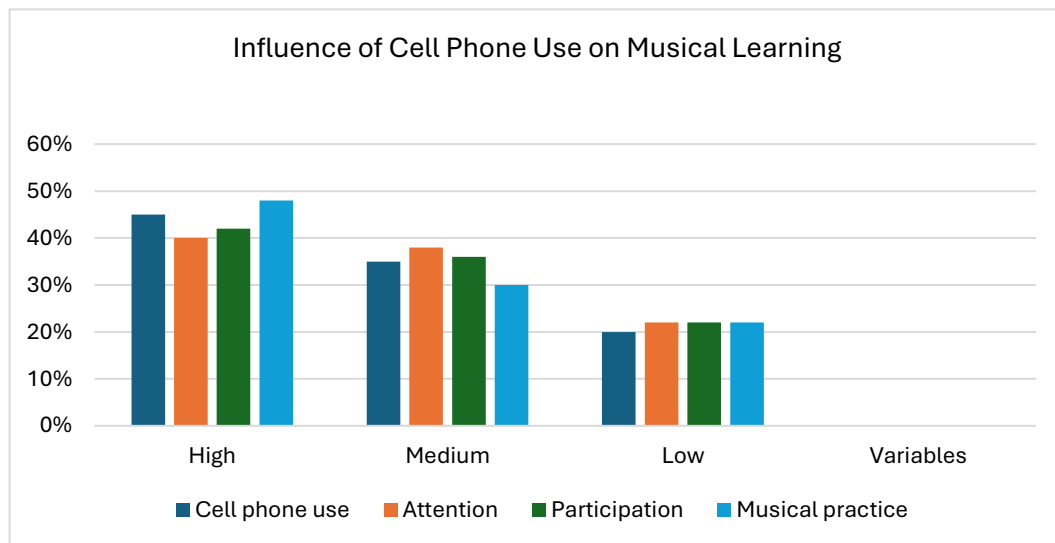
could be associated with the type of use they make of the cell phone inside or outside musical activities.

Regarding participation, 42% of the students reached a high level, 36% a medium level, and 22% a low level. This shows that an important part of the students maintains active participation in the musical learning process, although individual differences persist that could be related to factors of motivation, discipline, or technological use.

On the other hand, the musical practice dimension presented the highest percentage at a favorable level, with 48% of students located at the high level, followed by 30% at the medium level and 22% at the low level. This finding makes it possible to infer that the cell phone could be used, in certain cases, as a support resource for instrumental practice and access to musical materials.

Figure 1

Figure title.



3.2. Discussion

The findings obtained in this study make it possible to recognize that cell phone use occupies a relevant place in the musical learning process of the students in the school band of Pedro Vilcapaza Secondary School. The percentages obtained show that a considerable proportion of students are located at high levels both in cell phone use and in dimensions of musical learning, which suggests a functional relationship between both elements within the educational context.

These results are consistent with UNESCO (2019), which points out that mobile devices constitute tools with educational potential when they are used in an oriented and relevant manner. Similarly, Ally (2009) and Traxler (2018) argue that mobile learning promotes flexibility, immediate access to content, and continuity of learning outside the classroom, aspects that can be especially useful in musical training.

In relation to attention, the results show that an important part of the students maintains favorable levels; however, there is also a group that presents medium and low levels. This finding can be interpreted in light of what Lepp et al. (2015) and Rosen et al. (2013) point out, namely that frequent cell phone use can generate interruptions in concentration and affect students' attentional persistence. In the case of musical learning, this situation is particularly relevant, since instrumental performance and group coordination require high levels of concentration.

Regarding participation, the results suggest that the cell phone can play a dual role. On the one hand, it can strengthen student involvement through support resources, recordings, exercises, or motivating content; on the other hand, its unregulated use can reduce direct interaction with musical practice. This result is related to what Gikas and Grant (2013) state, namely that technology can foster participation when it is pedagogically integrated.

In the musical practice dimension, the results show a favorable trend, which makes it possible to consider that the cell phone can become a useful tool to reinforce autonomous learning. This finding is consistent with Biasutti (2015), Bauer (2014), and Dorfman (2013), who argue that technology can strengthen musical training by facilitating access to materials, exercises, and self-learning experiences.

However, it is important to recognize that the present study was mainly based on a descriptive analysis using frequencies and percentages; therefore, its findings should be interpreted within that scope. Likewise, the study was carried out in a specific context, which limits the generalization of the results to other educational realities.

Overall, the results suggest that the cell phone can represent both a pedagogical opportunity and a distracting factor in musical learning. Its influence will depend, to a large extent, on the educational guidance it receives and on the way it is incorporated into students' training practices.

IV. Conclusions

Cell phone use constitutes a present and relevant element in the musical learning process of the students in the school band of Pedro Vilcapaza Secondary School, showing its influence on dimensions such as attention, participation, and musical practice.

The results obtained make it possible to identify that the cell phone can fulfill a favorable pedagogical function when it is used to access musical resources, reinforce instrumental practice, and support students' autonomous learning.

Likewise, it was observed that unregulated cell phone use can generate less favorable effects, especially when it interferes with concentration, continuity of practice, or student commitment during musical activities.

Consequently, it is concluded that the cell phone should not be understood solely as a distractor, but as a technological tool with educational potential, whose effectiveness depends on its responsible, planned, and pedagogically oriented use within the musical learning process.

Finally, it is recommended to promote technological integration strategies in music education that make it possible to take advantage of the benefits of the cell phone as a learning support resource, without neglecting discipline, attention, and students' active participation.

Ethics Statement

This research was carried out in accordance with fundamental ethical principles such as respect, confidentiality, responsibility, and transparency in the handling of information. Student participation was conducted within a framework of respect for their rights and the corresponding institutional conditions. Likewise, the information collected was used exclusively for academic and research purposes.

Acknowledgment

Special thanks are extended to Pedro Vilcapaza Secondary School for the facilities provided for the development of the study, as well as to the students who are members of the school band for their participation and willingness during the data collection process.

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Stylistic Differences of Traditional Huayños Performed by Estudiantinas in the Northern Zone of the Puno Region

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ABSTRACT

The huayño pandillero constitutes a fundamental element of Puno's cultural heritage, where estudiantinas preserve sonic traditions that express cultural identity during carnival festivities and competitive events within the regional northern zone's festive calendar. This research aimed to determine the stylistic differences among traditional huayños performed by estudiantinas from the provinces of Melgar, Lampa, Huancané, Azángaro, and Carabaya. A qualitative methodology with an ethnographic approach was employed, conducting musical transcriptions and formal, thematic, and harmonic analysis, complemented by interviews, participant observation, and bibliographic review. Results revealed that stylistic differences lie primarily in rhythmic structure, followed by thematic development and technical-performance qualities, with contrapuntal variations in guitar playing being particularly distinctive. Regarding formal structure, Melgar predominantly features ternary form (A-B-A), whereas Lampa and Azángaro favor binary form (A-B); Huancané and Carabaya exhibit simplified binary structures. Harmonic progressions show similarities among Melgar, Azángaro, and Carabaya (VII-III-V7-i), while Lampa typically initiates progressions from the III or i degree. Concerning performance techniques, *bordoneo* (a strumming/arpeggio guitar technique) predominates, along with the use of hexatonic scales across all provinces, except Huancané, which employs heptatonic scales. Tempo ranges between 76 and 94 bpm, with slower values observed in Huancané (76–79 bpm) and faster tempos in Melgar and Lampa (87–94 bpm). It is concluded that these differences function as sonic markers of provincial identity, enabling regional characterization of the traditional huayño pandillero as intangible musical heritage deserving safeguarding and cultural preservation strategies.

Keywords: estudiantina, huayño pandillero, musical analysis, musical form, musical style.

I. Introduction

The Estudiantinas and Musical Centers of Puno constitute a fundamental element within the academic and traditional sphere of the region, representing musical institutions of deep historical roots that have transcended generations (Aguilar, 2012). These musical ensembles originated in the carnivals of Puno in the late nineteenth century through the convergence of diverse social strata of the city of Puno, particularly among young students and artisans who adopted European instruments while adapting them to Andean sensibilities (Aguilar, 2012). The Puno Estudiantina and/or Musical Center represents an organized ensemble of musicians who perform huayños pandilleros, Puno-style marineras, captaciones, and other musical genres adapted to the social context of the high plateau, constituting a collective artistic expression with its own identity (Aguilar, 2012).

The territorial expansion of these musical institutions occurred from the city of Puno toward all provinces during the first half of the twentieth century, generating a process of regionalization that enabled the consolidation of local styles with distinctive characteristics (Aguilar, 2015). This diffusion was neither homogeneous nor uniform; rather, it responded to particular social, economic, and cultural dynamics specific to each province, resulting in each context developing singular qualities in the performance and composition of the traditional huayño pandillero (Aguilar, 2012). Music, as a complex cultural phenomenon, must be studied within its context according to the foundational principles of ethnomusicology that privilege a holistic understanding of musical practices (Cámara de Landa & Díaz Collao, 2019). However, for this study, priority was given to an analytical musicological approach that values the intellectual development of music through the systematic examination of its structural elements, enabling the precise identification of differentiating patterns (Holzmann, 1987).

Musical sound can only be produced by humans, and human behavior produces music in a continuous process of cultural creation and recreation (Godenzzi, 1996). This conception reinforces the necessity of analyzing the structural elements of the huayño pandillero to understand its regional stylistic differences as manifestations of collective identity. The Estudiantina has been a principal factor in determining the origin and evolution of the Huayño Pandillero as a distinctive musical genre of the Puno region (Aguilar, 2012). The arrival of the Estudiantina Fígaro in America from Europe and its subsequent expansive influence on the continent gave rise to hybrid musical forms that, in the case of Puno, consolidated into the characteristic huayño pandillero, distinguished by its syncopated rhythmic structure and its social function within festive contexts (Aguilar, 2012).

Various previous studies have addressed specific aspects of Puno's music without conducting exhaustive regional comparative analyses. Aguilar (2007) performed a structural analysis of the huayño pandillero from the city of Puno without including

other provinces in his sample, thus limiting the understanding of intra-regional stylistic variations. Bustinza (2014) specifically studied the function of the trumpet in *estudiantinas*, contributing knowledge about a particular instrument but without addressing the overall musical structure. Cuentas (1997) described the dance and choreography of the Puno Pandilla from aesthetic and symbolic perspectives, focusing on the choreographic component rather than on musical analysis *per se*. Patrón (1984) addressed a contextual and ethnographic view of the Puno Pandilla as a social institution, without delving into the technical elements of the compositions. Siancas (1995) historically investigated the musical expressions of the province of Melgar, including records of *estudiantinas*, but without establishing systematic comparisons with other provinces of the region.

Music is essentially movement that is never in absolute repose, constituting an organized succession of sounds in time that generates dynamic perceptions in the listener (Rue, 1989). Any isolated sound induces perceptual movement even when it appears alone in the musical discourse. A succession of notes may carry infinitely distinct meanings depending on the composer's intention, the performer's interpretation, or the listener's reception (Rue, 1989). This suggestive flexibility of musical connotations implies inherent ambiguities that make it difficult to explain in a univocal manner the movement and musical forms without resorting to systematic structural analyses (Rue, 1989). Musicological analysis must create artificial situations where the artistic form is momentarily "frozen" through transcriptions and graphic representations that allow each element to be studied separately without losing sight of its integration within the whole (Rue, 1989).

To analyze a musical style rigorously, it is necessary to understand not only isolated elements but also their functions and interrelationships within the musical system (Rue, 1989). This enables meaningful interpretations by identifying important structural aspects of each piece in relation to the composer's historical context and sociocultural environment. Methodologically, musical analysis is divided into three complementary analytical dimensions: small (motive, semiphrase, phrase), medium (period, paragraph, section), and large (movement, complete work, group of related works) (Rue, 1989). These dimensions allow for the systematic structuring of the study of musical compositions from the micro to the macro level, facilitating valid comparisons among different regional styles.

Robles (n.d.) proposes three fundamental and sequential steps for rigorous musical analysis. First, precisely recognize the different constituent elements of the work: form, melody, rhythm, texture, harmony, timbre, and dynamics as independent yet interrelated analytical dimensions. Second, study the functional relationships within each element and the interactions among them to comprehend the underlying compositional logic. Third, draw conclusions about the coherence of these relationships and the expressive intention of the composer or musical tradition (Robles, n.d.). This three-dimensional approach is particularly adaptable for visualizing comparative

analysis with key concepts related to thematic development and regional stylistic variations.

Clemens Kuhn proposed a scale of four fundamental analytical categories for studying musical relationships within a work: repetition (identical reiteration of material), variation (partial modification while preserving essential traits), contrast (clear opposition of elements), and lack of relationship (absence of perceptible connection) (Robles, n.d.). These indicators function effectively in comparative musical analysis by allowing the quantification and qualification of compositional strategies employed in different regional traditions. Dynamics are conceptualized as the intensity of sound indicated by conventional markings (p, mp, mf, f) but also encompass implicit dynamics derived from rhythmic and melodic structure, spanning a continuous spectrum from the loudest to the softest (Rue, 1989).

Belinche and Larrégle (2006) establish a profound relationship between musical form and verbal language, affirming that all musical forms possess expressive virtue in themselves beyond their semantic content. Form is nothing other than organized structure with internal logic and aesthetic coherence. The concept of musical form is not limited to internal mathematical proportions but also encompasses the manner in which structural components act within an organic whole (Belinche & Larrégle, 2006). Form constitutes a set of interrelated components and the functional relationships among them, although this formal description reveals little regarding its specific expressive and cultural nature.

Musical rhythm represents one of the most important and differentiating elements for constructing the stylistic identities present in the traditional huayño pandillero (Belinche & Larrégle, 2006). Rhythm is the structural reason for the flow of sonic movement and its intrinsic temporal becoming, constituting the organized temporal dimension of music. Music is essentially temporal dynamics, where rhythm represents the intuitive category that allows conceiving and organizing the temporal order of sounds (Belinche & Larrégle, 2006). There is no rhythm prior to or subsequent to the sonic event; rather, each musical event deploys its specific rhythm in the course of its own temporal production, generating recognizable patterns that define regional styles.

This research focuses on exhaustively analyzing the stylistic differences of traditional huayños through the systematic study of their formal structure, thematic development, harmonic progression, and instrumental performance techniques. This multidimensional approach will enable precise characterization of the musical particularities of each province in the northern zone of Puno as manifestations of regional cultural identity. The analysis is conducted exclusively on traditional huayños pandilleros that meet rigorous authenticity criteria: a minimum age of 20 years since composition and recording by more than three different musical ensembles, which guarantees their representativeness and rootedness in local tradition. This rigorous methodological delimitation ensures the historical authenticity and cultural

representativeness of the analyzed samples, excluding recent compositions or those with limited diffusion that do not reflect the consolidated traditional heritage.

The research gap this study aims to address lies in the absence of systematic comparative studies analyzing the intra-regional stylistic differences of the huayño pandillero in the northern zone of Puno. Previous studies have been limited to local analyses or to the city of Puno without establishing structural comparisons among provinces. This work contributes to Andean musicological knowledge through the rigorous documentation of regional stylistic variations that, although subtle, constitute identity-based cultural heritage susceptible to preservation and intergenerational transmission in a context of globalization that threatens the homogenization of local musical expressions.

II. Methodology

The type of research employed was qualitative with an ethnographic approach according to Roman (2009). This approach allows inquiry into life as it unfolds and captures what occurs in context without interference other than the researcher's own presence. The research was conducted in the provincial capitals of the northern zone of the Puno region: Ayaviri (Melgar), Lampa (Lampa), Huancané (Huancané), Azángaro (Azángaro), and Macusani (Carabaya).

The research level was classified as basic in terms of its purpose. The temporal scope was cross-sectional, and its explanatory depth was qualitative with an ideographic conception of the phenomenon, dedicated to understanding the individual and unique particularities of the study objects (Sirvent, 1991). The temporal dimension was descriptive with macro-sociological breadth.

The population consisted of traditional huayños pandilleros existing in the region. According to Aguilar (2012), there are approximately 1,745 huayños, both pandilleros and non-pandilleros, in the general repertoire. The sample was selected by applying rigorous inclusion and exclusion criteria. Inclusion criteria were: huayños pandilleros, traditional huayños with a minimum age of 20 years, and huayños recorded by more than three different ensembles. Exclusion criteria were: non-pandillero huayños, ballroom huayños, and non-traditional huayños.

Data collection techniques included observation guides through listening to the proposed pieces. Directors of musical centers and estudiantinas were interviewed to obtain historical data. Formal analysis, thematic analysis, and harmonic analysis were applied to the musical transcriptions produced. Knowledgeable individuals in the field were also consulted to validate the findings.

Data collection was carried out through exhaustive bibliographic review, semi-structured interview techniques, and observation guides of the most frequently performed musical productions in each province. Subsequently, musical transcription

and corresponding analysis were conducted using specialized software. Results are presented through comparative tables and graphic representations of the analyzed musical elements.

III. Results and Discussio

3.1. Results

The stylistic differences of traditional huayños performed by estudiantinas in the northern zone of Puno manifest systematically across four complementary analytical dimensions: formal structure, thematic development, harmonic progression, and instrumental performance techniques. These dimensions interact to form recognizable provincial sonic identities acknowledged by local musicians and audiences familiar with the genre.

Table 1

Results - Formal structure overview

Comparative bar chart showing percentage of ternary vs binary forms by province

Province	Predominant Form	Structure	Characteristics
Melgar	Ternary (A-B-A)	Intro-Huayño-Fuga	Elaborate, symmetrical, balanced
Lampa	Binary (A-B)	Intro-Huayño	Brief intros (7-8 measures), narrative continuity
Huancané	Binary (A-B)	Intro-Huayño	Minimalist, simplest structures
Azángaro	Variable	A-B / A-B-C / Single phrase	Greatest variability, structural freedom
Carabaya	Mostly Binary	A-B (some A-B-A)	Mixed approach, expressive

In the dimension of formal structure, the province of Melgar shows a clear predominance of ternary form comprising three clearly differentiated sections: introduction (A), the huayño proper (B), and fuga (A). This classical structure is consistently observed in representative huayños such as "Kulquito" and "Huallatita de la Moya," where the introduction develops ternary phrases organized according to the scheme (a-a-a') with progressive melodic variations. The body of the huayño presents two main musical phrases with clearly defined question-and-answer organization, while the fuga faithfully reproduces the thematic material of the introduction, closing the formal cycle symmetrically. This ternary structure reflects a balanced and symmetrical compositional conception inherited from European models adapted to the Andean context.

The province of Lampa predominantly opts for binary structure consisting of two main sections: introduction (A) and huayño (B), without including a fuga in most of its traditional compositions. The huayños "Quien va a Lampa cae a la Trampa" and "Cholo Lampeño" feature brief introductions of 7–8 measures that establish a direct and organic relationship with the second phrase of the huayño, generating a sense of narrative continuity between both sections. This structural characteristic makes Lampeño compositions shorter in extension than those from Melgar, prioritizing formal economy over structural elaboration. The huayño "Huajcha Puquito" represents a notable exception within the Lampeño repertoire by presenting ternary structure (A-B-A) including fuga, suggesting external influences or a later stylistic evolution in this particular case.

Huancané presents exclusively binary structures without fuga in the analyzed huayños ("Así es el Huancaneño," "Celosa," and "Cerro Calacumo"), constituting the most structurally minimalist style among the five provinces studied. Huancaneño introductions are the simplest among all provinces, frequently developed exclusively based on the tonic chord triad without additional melodic elaboration. There is no direct relationship or shared motifs between the rhythmic designs of the introduction and the huayño proper, as occurs in other provincial styles, generating a sense of juxtaposition rather than organic integration between sections. The structure of the huayño itself is similar to the Lampeño style in its basic phrasal organization, but with generally lower rhythmic and melodic complexity.

Azángaro shows the greatest structural variability among all analyzed provinces, perhaps reflecting a more heterogeneous formative history or greater local compositional freedom. The huayño "Azangarina Cholada" presents an unusual three-part structure (A-B-C) where the third section (C) does not correspond to the introduction as would be expected in a classical ternary form, but instead introduces new thematic material that functions as a closing section. "Azangarino Lunthata" maintains a conventional binary structure (A-B) without fuga. "15 de Agosto" represents the extreme case of structural simplicity by lacking both introduction and fuga entirely, constituting a single continuous musical phrase of 36 measures that develops its musical argument without marked formal divisions. This structural simplicity could historically be due to the lack of composers with extensive theoretical musical knowledge in the initial stage of formation of the Azangarino style, or alternatively to a local aesthetic that privileges narrative fluidity over formal segmentation.

Carabaya presents predominantly binary structures with some ternary exceptions. "Macusaneñita" has ternary form (A-B-A) with a fuga identical to the introduction, showing fidelity to the classical model in this particular case. "Pañuelito" and "Recuerdos de Macusani" are binary (A-B) without fuga, representing the predominant Carabaya tendency. In some cases, introductions do not share rhythmic or melodic designs with the huayño proper, generating marked contrasts between both sections that

function as expressive resources rather than structural deficiencies. This characteristic suggests a compositional aesthetic that values dramatic contrast between sections as a legitimate expressive resource.

In thematic development, all provinces employ the three fundamental procedures proposed by Kuhn: repetitions, variations, and contrasts as main compositional strategies for articulating musical discourse. Melgar, Lampa, and Carabaya present the same characteristics in the balanced use of these three indicators, additionally incorporating counterpoint in the guitar systematically as a textural enrichment resource. Azángaro stands out for the predominant use of repetitions and contrasts with scarce application of melodic variations and instrumental counterpoint, generating a more direct and less contrapuntally elaborated musical discourse. Huancané shows incidence with repetitions and contrasts as main procedures, with occasional presence of counterpoint but with lower complexity in melodic variations compared to other provinces, again reflecting its minimalist aesthetic.

Table 2

Harmonic progressions

Comparative bar chart showing harmonic progressions by province

Provincial Group	Introductory Progression	Sensation
Melgar, Azángaro and Carabaya	VII-III-V7-i	Characteristic modal tension
Lampa	III or I (without initial VII)	Immediate stability
Huancané	I-VII-VI-III-V-I	Distinctive harmonic logic, possible conservative highland influence

The harmonic progression of the introduction shows structural similarities among Melgar, Azángaro, and Carabaya, which generally begin with the sequence VII-III-V7-i degree in minor tonalities, establishing a modal cadence characteristic of the traditional huayño pandillero. Lampa differs clearly by initiating the introduction harmonically from the III or i degree directly, omitting the initial VII degree and generating a sense of immediate stability rather than the modal tension produced by the VII degree. Huancané presents a unique and distinctive harmonic progression that begins and ends with I-VII-VI-III-V-I in its introductions, showing a harmonic logic different from the rest of the provinces that could be related to more conservative high plateau musical influences.

In the huayño proper, all provinces use harmonic progressions based fundamentally on the degrees VI-III-V7-i with variations in the specific order and frequency of appearance of each degree according to the province. The authentic perfect cadence (V7-i) is predominant in all final resolutions of phrases and sections, constituting a

unifying element of the genre despite provincial differences in other structural aspects. Harmonic variations among provinces manifest primarily in passing degrees and in the relative duration of each chord within the progression, rather than in the fundamental sequence of degrees used.

Table 3

Results - instrumental techniques

Instrument distribution map showing which instruments are used in which provinces

Instrument	Technique	Provinces	Function
Guitar	Bordoneo (thumb plucking)	All	Rhythmic-melodic counterpoint
	Arpeggios	All	Specific sections
	Coordinated fingers (i,m,a,p)	All	Dense textural passages
Mandolin	Continuous tremolo	All	Defining timbral element
	Main/secondary voice	All	Melodic function
Chillador	Strumming	Lampa, Carabaya	Harmonic function (distinctive marker)
Accordion	Melody + thirds	All	First/second voice

Instrumental performance techniques reveal differential patterns by province that constitute authentic stylistic markers recognizable by ear. The guitar stands out for the plucking technique followed by the thumb finger locally termed "bordoneo," which performs a rhythmic-melodic counterpoint not strictly rigorous with the main melody. This resource is occasionally accompanied by arpeggios in specific sections and by coordinated joint action of the fingers i, m, a, and p of the right hand in passages of greater textural density. The mandolin fulfills the characteristic function of emitting continuous tremolo while occasionally carrying the main and secondary voice in all provinces, constituting a defining timbral element of the pandillero sound.

The chillador, a plucked string instrument of Andean origin, is used exclusively in Lampa and Carabaya through the strumming technique in harmonic function of the tonality chords, constituting a distinctive stylistic marker of these two provinces not found in the rest of the northern zone. The charango appears occasionally in Azángaro with tremolo technique similar to the mandolin but with a higher register, adding characteristic timbral color to Azangarino performances. The accordion, when present, carries the first melodic line and second voice at intervals of major and minor thirds in all provinces, alternating rhythmically with the execution of the complete chord triad as a textural variety resource.

Regarding the modal scale used in the melodies, compositions predominate based on the hexatonic scale with systematic absence of the VI degree of the melodic minor scale

in the main melody, generating a modal sonority characteristic of the Andean high plateau. Huancané constitutes the notable exception by consistently using complete heptatonic scales in its compositions, including the VI degree in the melodies and generating a sonority closer to Western tonal models than the rest of the provinces. Tempo varies significantly among provinces, constituting a fundamental stylistic marker: Melgar and Lampa oscillate between 87–94 beats per minute, reflecting a more festive and dynamic character; Azángaro and Carabaya between 79–87 bpm, showing an intermediate balance; Huancané presents the slowest and most solemn tempo with 76–94 beats per minute, suitable for a more relaxed and ceremonious dance. The most frequent tonalities are A minor (predominant in Melgar and Carabaya), E minor (Huancané and Lampa), and B minor (Azángaro), showing a clear preference for minor tonalities that reinforce the melancholic and nostalgic character of the genre. The rhythm in all provinces maintains the characteristic irregular meter through the constant combination of 2/4 and 3/4 time signatures within the same phrase, thetic beginning (on strong beat) and masculine ending (on strong beat), with syncopated rhythmic designs that constitute the rhythmic identity marker of the huayño pandillero compared to other huayño subgenres.

3.2. Discussion

The findings confirm that the stylistic diversity of the huayño pandillero does not respond to random variations, but to processes of historical regionalization documented by Aguilar (2015), who notes that the provincial expansion of *estudiantinas* generated differentiated local adaptations. Although Landa and Díaz (2019) propose a holistic ethnomusicological approach to understanding these practices within their festive context, the results validate Holzmans's (1987) position by demonstrating that structural musicological analysis allows objectifying differentiating patterns without disconnecting them from their identity function. The confrontation between both approaches reveals that, far from being mutually exclusive, analytical rigor complements cultural understanding, since the formal and harmonic differences documented function as sonic markers that performers and communities intuitively recognize as characteristic of each province.

The predominance of binary and ternary forms, together with the systematic application of repetition, variation, and contrast, corroborates the operational utility of Kuhn's analytical scale for quantifying regional compositional strategies. This dialectical classification makes it possible to evidence how Melgar and Lampa balance these procedures with guitar counterpoint, while Huancané and Azángaro privilege repetition and contrast, reflecting an aesthetic of formal economy that contrasts with the structural elaboration of other provinces. This finding engages critically with Rue (1989), who warns about the inherent ambiguities of musical movement, but demonstrates that by "freezing" form through transcriptions, it is possible to unravel the underlying compositional logic. Likewise, the structural variability of Azángaro and the simplicity of Huancané validate Belinche and Larrégles's (2006) assertion that musical form is not

a rigid mathematical scheme, but an organic structure that responds to historical contexts and local knowledge, prioritizing in some cases narrative fluidity over formal segmentation.

Differences in introductory harmonic progressions (VII-III-V7-i in Melgar, Azángaro, and Carabaya versus direct initiation on III or i in Lampa and the sequence I-VII-VI-III-V-I in Huancané) reveal how modal tension and tonal stability operate as provincial expressive resources. These results expand the understanding of rhythm as the "structural reason for the flow of sound" proposed by Belinche and Larrégle (2006), by demonstrating that the irregular meter 2/4–3/4, combined with differentiated tempos (76–94 bpm), not only organizes musical time but also modulates the festive or ceremonial function of each variant. Rue's (1989) conception of music as perceptual movement and organized succession in time finds empirical verification here: tempo variations and the unifying authentic cadences (V7-i) of the genre demonstrate that, despite provincial diversity, there exists a common rhythmic-harmonic substratum that sustains the identity of the huayño pandillero. Godenzzi (1996) reinforces this interpretation by arguing that human behavior produces music in a continuous process of cultural recreation, where each province adapts the Andean tonal language to its own temporal and spatial dynamics.

The differentiated distribution of instruments and techniques (bordoneo in guitar, mandolin tremolo, exclusive presence of the chillador in Lampa and Carabaya, or the charango in Azángaro) constitutes empirical evidence that overcomes the limitations of previous fragmented studies. While Bustinza (2014) focused on the trumpet and Cuentas (1997) prioritized choreography, current results demonstrate that sonic identity is constructed through the textural interaction of multiple instrumental voices, validating the need for integral ensemble analysis. The predominance of hexatonic scales, with the heptatonic exception of Huancané, confirms Patrón's (1984) observation about the Pandilla as a social institution with differentiated musical practices, but adds the technical precision that his ethnographic approach omitted. Likewise, the finding contrasts with Aguilar's (2007) analysis, limited to the city of Puno, by demonstrating that performance techniques are not uniform throughout the region, but rather operate as auditory codes that delimit symbolic boundaries between provinces, reinforcing Siancas' (1995) idea about the need to historically record local expressions to avoid their homogenization.

Finally, it is necessary to acknowledge the limitations of the present study to guide future research. The analysis was limited to the northern zone of Puno, excluding the central and southern provinces of the region that could show additional differential patterns. The focus on traditional huayños with more than 20 years of antiquity does not capture contemporary stylistic innovation processes currently occurring in youth *estudiantinas*. Future research should address these gaps through longitudinal studies documenting stylistic evolution in real time, interregional comparative analyses including other zones of Puno and the Bolivian high plateau, and in-depth ethnographic

studies exploring the subjective aesthetic conceptions of the musicians themselves regarding the stylistic differences that this research has objectively documented.

IV. Conclusions

The estudiantinas of northern Puno develop differentiated styles of huayño pandillero that reflect provincial cultural identities through variations in four interrelated dimensions: formal structure (Melgar prefers ternary form with elaborate introductions; Lampa, Azángaro, and Huancané opt for binary structures of increasing simplicity; Carabaya shows an intermediate style), thematic development (balanced use of repetition, variation, and contrast in Melgar, Lampa, and Carabaya versus predominance of repetitions and contrasts in Azángaro and Huancané), harmonic progression (modal sequence VII-III-V7-i in Melgar, Azángaro, and Carabaya; direct initiation on III or i in Lampa; unique progression I-VII-VI-III-V-I in Huancané), and instrumental technique (presence of the chillador only in Lampa and Carabaya, exclusive use of heptatonic scales in Huancané versus hexatonic scales in the rest). These differences are complemented by variations in tempo (faster in Melgar and Lampa, slower in Huancané) and predominant minor tonalities (A minor, E minor, B minor), maintaining as constants the irregular meter (2/4 and 3/4), thetic beginning, and final cadence V7-i. Far from being mere technical details, these particularities constitute sonic manifestations of historically constructed regional identities, whose preservation is urgent given the risks of cultural homogenization in contexts of globalization.

Ethics Statement

The research was conducted in strict compliance with necessary ethical requirements throughout the entire investigative process, from planning to dissemination of results. Principles of methodological transparency, informed consent, and protection of the rights of all involved agents were respected at all times, including musicians, directors of musical institutions, key informants, and copyright holders of the historical recordings analyzed. Musical transcriptions were performed exclusively for academic purposes and preservation of intangible cultural heritage, without commercial intent or improper appropriation of collective musical creations. Names of traditional composers were acknowledged and cited when it was possible to identify them historically, thus respecting the moral right of collective authorship inherent to Andean oral musical traditions. The research results were returned to the participating musical communities through public presentations in each province, thereby ensuring community feedback and social control over the findings generated from their own cultural heritage.

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Influence of Music Genres with Andean Content on the Components of Peruvian National Identity

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ABSTRACT

This study aims to analyze the influence of different music genres with Andean influences (Huayno, Chicha, and Rock/Fusion) on the components of Peruvian national identity. To this end, a pre-post experimental design was implemented, involving 92 upper-middle-class participants aged between 18 and 25 years ($M = 19.91$, $SD = 1.95$). Participants were randomly assigned to one of three experimental groups exposed to each of the aforementioned music genres: Huayno ($n = 30$), Chicha ($n = 31$), and Rock/Fusion ($n = 31$).

The results show that Chicha is the least valued music genre, potentially generating a less favorable image of Peru. In contrast, Huayno and Rock/Fusion appear to foster more positive self-stereotypes about Peruvians, as well as higher levels of positive emotions compared to those elicited by Chicha. In conclusion, music genres with Andean roots do influence Peruvian national identity, although in differentiated ways depending on the genre. Rock/Fusion generated more positive perceptions, Huayno received an intermediate evaluation, while Chicha, despite being recognized as representative of Peru, was associated with lower evaluations and less favorable emotions. However, the findings suggest that music does impact how national identity is perceived, although it does not substantially alter the sense of belonging.

Keywords: Chicha, national identity, music genres, musical influence, Peru.

I. Introduction

Peña, (2021) states that music has a wide variety of functions in human life, but most of them are essentially social, since, despite language and culture sometimes representing a barrier in intergroup relations (p. 13). During the 1940s and 1950s, a certain regional awareness was still present. In the provinces, traditions, music, gastronomy, poetry, and entrepreneurship flourished. The elites of Lima and the coastal northern regions, envious of these advances, initially sabotaged progress by hindering

bureaucracy (Loayza, 2022), According to Ad (2026) in Peru there is musical talent, but it is often wasted on producing cover songs; additionally, Peruvians have been taught that what is good comes from abroad and that Andean music is for the poor. Colombia, in contrast, presents a diversity of traditional musical genres that express the richness of its culture according to each region. This musical diversity is the result of a mixture of African, Indigenous, and European influences (Cruz et al., 2019) Music not only influences identity but also elicits individual emotional states and, reasonably, collective ones (Carranza, 2022), Guerrero (2012) notes that many expressions of popular music circulating in mass media result from the blending and fusion of different musical genres. Gautier & García (2009) argue that music has been at the forefront of discussions regarding the creation of artistic objects, their forms of exchange, and their legal status. Fellone (2022) highlights that, compared to cinema, studies on popular music have not paid equal attention to genres, and despite scattered attempts, there has been no sustained theoretically informed debate on shared issues. Music is liked because people consider it fundamental in their daily lives, as they identify with many aspects of its lyrics (Betancur & Quiceno, 2020) Each country has its own musical genres, but exchange and trade between countries allow them to become known worldwide (Capa Plascencia, 2014) Rock is a musical genre with a marked rhythm that emerges from the combination of other musical styles (Lucas Rodríguez, 2021) Music is a rich form of symbolic discourse that allows humans to articulate a sense of self and community. Listening to music is a complex experience, as it acts as a psychophysiological stimulus that activates bodily responses associated with a wide range of emotions (Santiago Jarava, 2025), Herrera & Oropeza (2013) Musical taste functions as a social credential of group affiliation and contributes to individuals' sense of identity. In this regard, national identity can be understood as the collective identity of a country (Pastor, 2016) Music is a cultural product, and it is important to recognize the influence of education on musical taste and genre preferences (Herrera & Oropeza, 2013) Latin music is characterized by incorporating folkloric elements from its country of origin into its musical identity and is often perceived as innovative and distinct from offerings of other countries (Celis, 2019) Music can transmit positive values but may also convey negative messages that incite violence in different forms (Torres et al., 2019) (Betancur & Quiceno, 2020) Music is in constant interaction with individuals and their environment, and it is rare to find someone without musical preferences, as this factor is part of all human beings (Jiménez, 2023) Music is a phenomenon of strong bodily receptivity, and its concept varies across cultures due to different tendencies and forms of expression (Delgado et al., 2017) Music functions as a symbolic language that allows individuals to express emotions, motivations, frustrations, experiences, moods, and conflicts, fostering the emergence of diverse musical genres across regions and historical periods (Rojas & González, 2012) Music as an industry also uses art for economic gain, creating symbols influenced by large corporations, and each genre has its own evolution, past, present, and future (Gómez, 2024) Music has been understood as a projection of human emotional experience (Stern & del Castillo, 2007) Genres are

intersubjective and inter-stylistic musical categories that refer not only to music itself but also to how it is combined with lyrical, visual, or choreographic elements embedded in a sociocultural context (Fellone, 2022) Music is not only produced by instruments but also by the human voice, and depending on its intention, it can evoke sensations of peace, joy, anger, or hatred (Cabrera, 2013) Music can help individuals overcome difficult moments and provide emotional comfort (Marín, 2023) Music is an art that represents a logical combination of sounds that pleases the ear according to established rules (Panchi Culqui et al., 2019) It is also used as a relaxation tool and as a means to educate emotions through musical practice and interdisciplinary activities (Fernández, 2024) Music is considered the universal language of humanity, and even in medicine it is studied as a relaxation method and as support within the field of music therapy (Sevillano, 2020)

II. Methodology

The present study was conducted under a quantitative approach and adopted a pre–post experimental design. This design allowed for the assessment of changes in various psychological variables before and after exposure to specific musical stimuli. Three experimental conditions were established, corresponding to music genres with Andean influences: Huayno, Chicha, and Rock/Fusion. Participants were randomly assigned to each condition in order to ensure group equivalence and control for potential extraneous variables.

Participants

The sample consisted of 92 university students from a private university in Metropolitan Lima. Participants' ages ranged from 18 to 25 years ($M = 19.91$; $SD = 1.95$), including 45 men (48.9%) and 47 women (51.1%).

Participants were distributed into three experimental groups: the group exposed to Huayno ($n = 30$), the group exposed to Chicha ($n = 31$), and the group exposed to Rock/Fusion ($n = 31$). No significant differences were found in musical preferences among the groups, suggesting homogeneous initial conditions.

As an exclusion criterion, individuals with formal musical training beyond basic schooling were excluded. All participants voluntarily agreed to take part in the study by signing an informed consent form.

Instruments

For data collection, various instruments validated and adapted to the Peruvian context were used.

First, a data sheet was employed to gather sociodemographic information, as well as musical preferences and listening frequency.

The level of identification with Peru was assessed using a single item with a five-point Likert-type response format.

Peruvian collective self-esteem was measured באמצעות a four-item scale based on an adaptation of the private collective self-esteem subscale, showing adequate reliability levels ($\alpha = .84$).

Additionally, a scale of ethnic identification and social group evaluation was applied, allowing the measurement of both the degree of identification with different groups and the evaluation attributed to them.

The national self-stereotypes scale, composed of 22 items, assessed dimensions such as competence, warmth, morality, and ideal nationalism, demonstrating adequate internal consistency indices in most of its dimensions.

To evaluate emotional responses, the Differential Emotions Scale was used, which measures the intensity of ten basic emotions in response to the musical stimulus.

Finally, an attitude toward music scale, specifically developed for this study, was employed. After an exploratory factor analysis, two main dimensions were identified: liking of the musical piece and perception of the image of Peru associated with it, both showing adequate levels of reliability.

Musical Stimuli

The experimental stimuli consisted of three instrumental musical pieces selected to represent each of the studied genres: Huayno, Chicha, and Rock/Fusion. The songs were previously evaluated by a pilot group to ensure accurate classification and to prevent prior recognition.

In order to control for external variables, the stimuli were standardized in terms of duration (between 3 and 5 minutes), tempo (110–120 bpm), tonality (minor), and the absence of lyrics, thereby avoiding the influence of verbal content on participants' responses.

Procedure

The study was conducted in several phases. Initially, a survey was carried out to validate the classification of the musical stimuli, followed by a pilot study aimed at refining the instruments and experimental conditions.

Subsequently, participants were recruited through social media announcements and direct contact. Assignment to the experimental conditions was carried out randomly using a digital tool.

The study was administered in group sessions within computer labs. Participants first completed a set of instruments (pre-test phase), followed by exposure to the

corresponding musical stimulus through headphones. Afterwards, they completed a second set of questionnaires (post-test phase), aimed at assessing changes in the variables of interest.

Data Analysis

Data analysis was conducted using statistical techniques appropriate for the experimental design. Exploratory factor analyses were performed to validate the structure of the instruments, and internal consistency was assessed using Cronbach's alpha coefficient.

Additionally, pre–post comparisons were carried out to evaluate changes in the dependent variables, as well as analyses of differences between experimental groups. These techniques made it possible to identify the effects of different music genres on the components of national identity.

III. Results and Discussion

3.1. Results

Differences in the level of national identification were analyzed through paired-sample mean comparisons between pre-test and post-test within each experimental condition.

In the Huayno condition, no significant differences were observed between the pre-test ($M = 4.10$, $SD = .66$) and the post-test ($M = 4.20$, $SD = .66$), $t(29) = -.83$, $p = .40$. Similarly, in the Rock/Fusion condition, differences between the pre-test ($M = 3.87$, $SD = .84$) and the post-test ($M = 3.90$, $SD = .74$) were not significant, $t(30) = -.44$, $p = .60$. In the Chicha condition, a marginally significant difference was found between the pre-test ($M = 3.68$, $SD = .74$) and the post-test ($M = 3.87$, $SD = .84$), $t(30) = -1.99$, $p = .05$, $d = .35$.

To assess differences between groups, a one-way analysis of variance (ANOVA) was conducted. No significant differences were found between conditions in the pre-test, $F(2, 89) = 2.38$, $p = .09$. Likewise, no significant differences were observed in the post-test, $F(2, 89) = 1.74$, $p = .18$, partial $\eta^2 = .03$.

Regarding collective self-esteem, in the Huayno condition no significant differences were found between the pre-test ($M = 4.40$, $SD = .50$) and the post-test ($M = 4.45$, $SD = .49$), $t(29) = -.74$, $p = .46$. In the Rock/Fusion condition, no significant differences were observed between the pre-test ($M = 4.30$, $SD = .82$) and the post-test ($M = 4.35$, $SD = .67$), $t(30) = -.46$, $p = .64$. In the Chicha condition, significant differences were identified between the pre-test ($M = 4.26$, $SD = .69$) and the post-test ($M = 4.06$, $SD = .88$), $t(30) = 2.53$, $p = .01$, $d = .45$.

The ANOVA did not show significant differences between groups in the pre-test, $F(2, 89) = .34$, $p = .71$, nor in the post-test, $F(2, 89) = 2.61$, $p = .07$.

Attitudes Toward Music

The three experimental groups were compared based on the factors of the attitude toward music scale using a one-way ANOVA.

For Factor 1 (liking of the music genre), significant differences were found between groups, $F(2, 89) = 6.13$, $p = .03$, partial $\eta^2 = .12$. Post hoc analysis with Bonferroni correction indicated that the Chicha condition ($M = 3.30$, $SD = 1.42$) had significantly lower scores compared to the Huayno condition ($M = 4.35$, $SD = 1.24$) and the Rock/Fusion condition ($M = 4.34$, $SD = 1.39$).

For Factor 2 (positive image of Peru), significant differences were also observed, $F(2, 89) = 8.46$, $p = .00$, partial $\eta^2 = .16$. Post hoc analysis showed that the Chicha condition ($M = 4.16$, $SD = 1.09$) obtained significantly lower scores compared to Huayno ($M = 5.20$, $SD = 1.04$) and Rock/Fusion ($M = 4.97$, $SD = .98$).

Identification and Evaluation of Peruvian Groups

A one-way ANOVA was conducted to analyze differences in the level of identification with different social groups. Significant differences were found only in the category “Peruvians in general,” $F(2, 89) = 4.45$, $p = .01$.

Post hoc analysis with Bonferroni correction indicated significant differences between the Huayno condition ($M = 4.20$, $SD = .55$) and the Chicha condition ($M = 3.65$, $SD = .75$).

Regarding the evaluation of social groups (both personal evaluation and evaluation attributed to the average Peruvian), analyses of variance indicated that no significant differences were found between experimental conditions in any case ($p > .05$).

Table 1

Comparison of Means Using ANOVA for Peruvian Self-Stereotypes Across Conditions

Variable	Huayno		Chicha		Rock/Fusión		<i>F</i>	<i>gl</i>	η^2
	<i>n</i>	<i>M (DE)</i>	<i>n</i>	<i>M (DE)</i>	<i>n</i>	<i>M (DE)</i>			
Moralidad	30	3.61(.77)	31	3.54(.84)	31	4.14(.85)	4.84**	(2 ^a , 89 ^b)	.09
Calidez	30	5.21(1.06)	31	4.65(1.01)	31	5.41(.90)	4.81**	(2 ^a , 89 ^b)	.09
Competencia	30	5.38(.73)	31	4.96(1.08)	31	5.38(.88)	2.21	(2 ^a , 89 ^b)	.04
Nacionalismo	30	3.86(1.01)	31	3.90(1.06)	31	4.33(.91)	2.08	(2 ^a , 89 ^b)	.04

* $p < .05$, ** $p < .01$; *a*=Intrasujetos, *b*=Intersujetos

Differences were only observed in the variables “Morality” and “Warmth.” Therefore, post hoc comparisons were conducted for these variables, and the significant results are presented below:

Table 2

Post Hoc Comparisons Using Bonferroni Correction for the Variables “Morality” and “Warmth”

Variable			Diferencia de medias (I-J)	95% IC dif. de medias	E.E.
Moralidad	Rock/Fusión	Huayno	.52*	[0.01, 1.05]	.21
		Chicha	.59*	[0.08, 1.11]	.21
Calidez	Rock/Fusión	Chicha	.75*	[0.13, 1.38]	.25

* $p < .05$

It is clearly observed that the Rock/Fusion condition shows a higher perception of Peruvians as more moral and warmer.

Table 3

Comparison of Means Using ANOVA for Emotions Across Conditions

Variable	Huayno		Chicha		Rock/Fusión		F	gl	η^2
	n	M (DE)	n	M (DE)	n	M (DE)			
Alegria	30	5.20(1.47)	31	3.93(1.63)	31	4.83(1.61)	5.23**	(2 ^a , 89 ^b)	.10
Sorpresas	30	3.53(1.81)	31	3.25(1.80)	31	4.45(1.82)	3.66*	(2 ^a , 89 ^b)	.07
Tristeza	30	2.66(1.89)	31	1.80(1.24)	31	2.22(1.62)	2.17	(2 ^a , 89 ^b)	.04
Interés	30	4.90(1.51)	31	3.64(1.92)	31	5.38(1.58)	8.79**	(2 ^a , 89 ^b)	.16
Ira	30	1.36(1.24)	31	1.32(1.04)	31	1.19(.54)	0.25	(2 ^a , 89 ^b)	.00
Asco	30	1.23(1.10)	31	1.29(.69)	31	1.19(.74)	0.09	(2 ^a , 89 ^b)	.00
Desprecio	30	1.43(1.30)	31	1.35(.75)	31	1.29(.97)	0.14	(2 ^a , 89 ^b)	.00
Miedo	30	1.53(1.33)	31	1.29(.90)	31	1.12(.42)	1.37	(2 ^a , 89 ^b)	.03
Culpa	30	1.63(1.54)	31	1.29(.78)	31	1.25(.72)	1.13	(2 ^a , 89 ^b)	.02
Vergüenza	30	1.40(1.22)	31	1.48(1.12)	31	1.09(.39)	1.33	(2 ^a , 89 ^b)	.02

* $p < .05$, ** $p < .01$; a=Intrasujetos, b=Intersujetos

It can be observed that there are three emotions for which differences exist between the groups, and these correspond to emotions considered positive.

Table 5

Post Hoc Comparisons Using Bonferroni Correction for the Variables “Joy,” “Surprise,” and “Interest”

Variable			<i>Diferencia de medias (I-J)</i>	<i>95% IC dif. de medias</i>	<i>E.E.</i>
Alegria	Chicha	Huayno	-1.27**	[-2.25,-.28]	.40
Sorpresa	Chicha	Rock/Fusión	-1.19*	[-2.32,-.07]	.46
Interés	Chicha	Huayno	-1.26*	[-2.31, -.20]	.43
		Rock/Fusión	-1.74*	[-2.79,-.70]	.42

* $p < .05$, ** $p < .01$

3.2. Discussion

The study aimed to analyze the influence of different music genres with Andean roots on the construction of Peruvian national identity. The results show that Rock/Fusion was the most highly valued genre, while Chicha received the lowest scores, partially confirming the initial hypothesis. Although Chicha is recognized as representative of the Peruvian context, it is associated with a less positive evaluation of the national group, revealing a complex relationship between identification with and evaluation of one’s own group. Herrera (2025) A relevant antecedent is the study by Henri Tajfel and John Turner on Social Identity Theory, which proposes that individuals construct their identity based on their membership in social groups. From this perspective, the study’s findings are consistent in showing that not all cultural expressions (such as music genres) are equally valued within the group itself, which may generate tensions between identification and evaluation.

This finding can be explained by historical and social factors, as Chicha emerged in contexts of migration, urbanization, and inequality, and has been stigmatized by higher-status social sectors. In contrast, Huayno, although also of Andean origin, maintains a certain symbolic distance in urban contexts, whereas Rock/Fusion, by integrating Andean elements with Western influences, is more widely accepted and generates more positive perceptions. Lázaro (2014) Chicha music emerged in contexts of migration and has been socially stigmatized. Likewise, cultural expressions of Andean origin have historically been devalued due to social inequalities.

Additionally, Chicha elicited lower levels of positive emotions, possibly due to its cultural and symbolic associations, whereas Rock/Fusion was associated with more favorable self-stereotypes of Peruvians, such as greater warmth and morality. Overall, the results reflect that certain cultural expressions generate a more intense yet also ambivalent national identity, revealing ongoing sociocultural tensions and inequalities. Encinas (2025) Chicha became a sonic archive and a counter-public sphere for

migrants, articulating their experiences of displacement, racism, and political violence. In this way, Chicha challenged the official narrative by reclaiming the voice and memory of marginalized popular sectors within the cultural history of contemporary Peru.

Finally, it is acknowledged that the study has limitations, such as the type of sample and the brevity of the stimuli. Therefore, future research should be expanded across diverse contexts and populations, as well as further examine perceptions of music genres in order to contribute to a more inclusive national identity.

IV. Conclusions

The present study aimed to analyze the influence of different music genres with Andean influences on components of Peruvian national identity. Based on the results obtained, it can be concluded that there are differences in the evaluation and effects of the music genres examined. First, Rock/Fusion was the most highly valued genre, showing associations with more positive perceptions of Peru and the national group. Huayno received an intermediate evaluation, while Chicha was the genre with the lowest overall valuation. Furthermore, although Chicha is perceived as representative of the Peruvian context, it was associated with a less positive evaluation of national belonging and lower levels of positive emotions. This reflects the presence of differentiated perceptions toward cultural expressions within national identity. On the other hand, no consistent significant differences were found in national identification among the groups, suggesting that brief exposure to musical stimuli does not substantially modify this component. Overall, the findings indicate that music influences the way national identity is perceived, revealing tensions between cultural valuation and social identification in the Peruvian context. Finally, it is recommended that future research include more diverse samples and longer exposure periods, as well as further explore music as a relevant element in the construction of social identity.

Ethics Statement

This article was developed for strictly academic purposes, based on the analysis of a study previously conducted by another author, fully respecting intellectual authorship and appropriately citing the corresponding sources.

Additionally, the original study was conducted with the participation of 92 university students from a private university in Metropolitan Lima, ensuring informed consent, data confidentiality, and the exclusive use of information for educational purposes. No risk was posed to participants, nor were their rights violated.

Acknowledgments

I would like to express my sincere gratitude to my family, especially my parents and my grandmother, for their unconditional support throughout this process. I also thank my advisor, Agustín Espinosa, for his trust, guidance, and continuous support. I extend

my appreciation to my classmates, friends, and all those who, in one way or another, contributed their academic, technical, and emotional support to the development of this thesis. Finally, I thank music, which accompanied me and provided meaningful moments throughout this journey.

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Analysis of the Didactic Methodology in Basic Concepts of Musical Language by Roberto P. Sosa.

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ABSTRACT

This study was conducted within the field of school music education, where difficulties in students' understanding of musical language were observed. Based on this issue. The objective was to analyze the pedagogical approach of the book *Basic Concepts of Musical Language* by Roberto P. Sosa, in order to assess its usefulness in teaching and learning processes. To achieve this, a qualitative methodology was employed, based on a systematic literature review following the PRISMA method criteria. This process allowed for the selection, analysis, and comparison of various theoretical sources, as well as a detailed examination of the main text's content. The findings showed that the work presents a clear and progressive structure, in which the elements of rhythm, melody, and harmony are balanced and well integrated. Additionally, it was identified that didactic resources, such as the inversion rule, facilitate the understanding of complex musical concepts. In conclusion, the method proposed by Sosa is presented as an effective alternative to improve musical literacy, as it promotes more comprehensive learning and the development of student autonomy.

Keywords: harmony, multiple intelligences, musical language, teaching.

I. Introduction

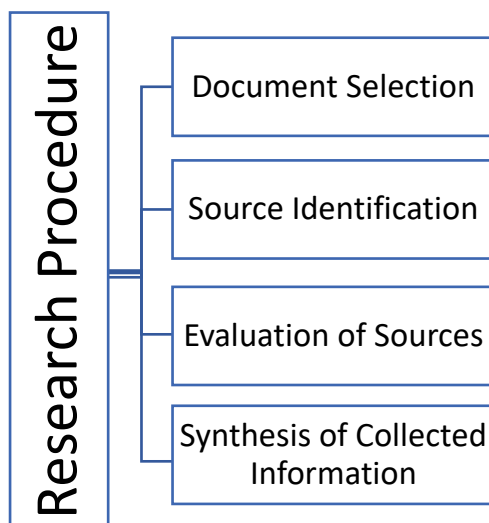
Music education in the 21st century has faced the challenge of integrating technical knowledge with the expressive dimension of art (Calderón-Garrido, 2019). In this context, musical literacy has been understood as a complex process that requires comprehensive pedagogical strategies (Pascual, 2002). Various studies have pointed out that traditional music education has tended to focus on mechanical repetition, limiting students' deep understanding (Hemsey de Gainza, 2002). In this regard, Swanwick (1991) argued that music learning should be oriented toward the construction of meaning rather than solely technical performance. On the other hand, Willems (2001) emphasized that rhythm constitutes the foundation of musical development, as it is closely linked to human experience. Additionally, music education

has begun to consider body movement as a key element within the learning process. In this context, Juntunen (2016) highlighted that the use of the body in musical activities allows for a better understanding of rhythm and facilitates more meaningful musical expression. Similarly, recent research has emphasized the importance of singing as a pedagogical resource in music education. In this sense, Welch (2015) pointed out that the use of the voice promotes the development of auditory perception and improves students' intonation. In addition, Gardner (1983) recognized musical intelligence as an essential capacity within an individual's cognitive development. From a more contemporary perspective, studies on music theory have addressed intervals as fundamental relationships between sounds within musical structure. In this regard, Lerdahl and Jackendoff (1983) explained that intervals play a key role in the organization and perception of musical language, contributing to the understanding of its internal structure. Subsequently, Piston (1987) noted that harmony helps to understand how music is structured and how it develops across different styles. Regarding musical understanding, Copland (1939) stated that theoretical knowledge enables more conscious and structured listening. In this sense, Sloboda (2005) indicated that deliberate practice is essential for the development of advanced musical skills. Furthermore, recent research has shown that music education contributes to students' cognitive, emotional, and social development (Hallam, 2010). Likewise, Hargreaves (2012) noted that musical learning fosters creativity and self-regulation. Moreover, studies have shown that structured pedagogical methods facilitate the progressive acquisition of musical language (Jorgensen, 2008). In this regard, Green (2002) emphasized the importance of contextualizing learning within meaningful experiences. Similarly, research such as Bowman (2004) highlighted the need for a more humanistic music education centered on the student. In the same vein, Elliott (1995) proposed a practical approach in which learning is constructed through musical experience. In relation to current approaches, various authors have highlighted the importance of renewing music education. In this sense, Burnard (2012) emphasized the need to promote creativity as a central component of learning. Likewise, Biasutti (2015) found that the use of innovative teaching strategies contributes to improving students' understanding of musical language. Abril (2013), for his part, stressed the need to adapt teaching to different educational contexts, promoting inclusion and active participation in the classroom. In the Latin American context, authors have emphasized the importance of integrating cultural identity into music education (Pérez, 2015). Similarly, Díaz (2018) highlighted that musical learning should be connected to the student's sociocultural context. Within this framework, the book *Basic Concepts of Musical Language* by Sosa (2010) is presented as a pedagogical proposal aimed at systematizing the teaching of musical language. According to the author, music can be taught in an accessible way through a clear and progressive structure. Likewise, the proposed method integrates rhythmic, melodic, and harmonic elements, facilitating a comprehensive understanding of musical language (Sosa, 2010). This perspective aligns with contemporary pedagogical approaches that promote meaningful learning

(Ausubel, 1983). Consequently, it was considered relevant to analyze this work through a systematic review in order to evaluate its contribution to music education in school contexts. The objective of this study was to analyze the pedagogical structure of Sosa's book, identifying its main didactic contributions and its potential impact on musical literacy.

II. Methodology

This research was conducted under a qualitative approach, using a systematic literature review design, following the guidelines of the PRISMA method (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). This approach allowed for an organized and rigorous analysis of theoretical information related to the teaching of musical language. In this regard, Codina and Lopezosa (2026) noted that the use of PRISMA enables the systematic structuring of the literature review process, ensuring greater transparency and rigor in the selection and analysis of sources. The study was descriptive-analytical in nature, as it aimed to identify, organize, and interpret the pedagogical contributions present in the work *Basic Concepts of Musical Language* by Sosa (2010). The design focused on documentary review, which facilitated the understanding of the didactic structure of the text in relation to relevant educational theories. The population consisted of academic literature related to music education and the pedagogy of musical language. The sample was intentionally selected, including relevant sources published between 1939 and 2019, as well as Sosa's main work (2010), which was considered the core of the analysis. A total of 27 academic sources were considered for the development of the study. Of these, 9 were scientific articles, 16 corresponded to specialized books, and 2 consisted of other academic materials, including book chapters and digital resources that served as complementary support for the analysis. Content analysis sheets were used as data collection instruments, allowing information to be organized into categories such as rhythm, melody, harmony, and teaching strategies. These tools facilitated the systematization of data and its subsequent interpretation. The research procedure was carried out in four phases. In the first phase, sources were identified through searches in academic databases such as Google Scholar, using keywords such as musical language, music education, and pedagogical innovation. In the second phase, documents were selected by applying inclusion and exclusion criteria, prioritizing relevant and up-to-date studies. In the third phase, the quality and relevance of the selected sources were evaluated. Finally, in the fourth phase, the collected information was synthesized and analyzed. For data analysis, the content analysis technique was applied, allowing the identification of patterns, relationships, and theoretical contributions within the studied text. Additionally, theoretical triangulation was used, contrasting Sosa's approach with authors such as Gardner, Willems, and Welch, in order to strengthen the validity of the study. In this way, the methodology employed ensured coherence, rigor, and replicability in the research process, allowing for reliable results regarding the analyzed pedagogical proposal.



3.1. Results

Based on the analysis of the book *Basic Concepts of Musical Language* by Sosa (2010), it was identified that the contents are organized progressively, advancing from basic aspects to more complex topics. This structure revealed a clear sequence in the development of musical learning. Regarding the distribution of topics, it was observed that the contents are mainly grouped into three areas: rhythm, melody, and harmony. Rhythm had a greater presence at the initial levels, while melody remained consistent between the basic and intermediate levels. Harmony, in turn, was addressed in greater depth at the intermediate and advanced levels. The inclusion of various didactic resources was also observed, such as practical exercises, musical examples, and the application of theoretical rules. These resources appeared more frequently in the early sections of the book, gradually decreasing as the complexity of the content increased. The table made it possible to observe how the contents of musical language are distributed according to their level of complexity within the analyzed book. First, rhythm had the greatest presence at the basic level (45%), and its proportion decreased at the intermediate (35%) and advanced levels (20%). As for melody, it maintained a similar distribution between the basic and intermediate levels (40% in both cases), decreasing at the advanced level (20%). On the other hand, harmony showed a different pattern, with lower presence at the basic level (20%), but increasing at the intermediate (35%) and advanced levels (45%). Overall, these data demonstrate a progressive organization of the contents throughout the text.

Table 1

Percentage distribution of musical language content in the analyzed work.

Variables	Basic (%)	Intermediate (%)	Advanced (%)
Rhythm	45%	35%	20%
Melody	40%	40%	20%
Harmony	20%	35%	45%

Note. The percentages reflect the relative presence of each musical component at the different levels of the book.

Regarding internal organization, a logical sequence among the topics was identified, where each content is related to the previous one, promoting continuity in learning. Likewise, the consistent use of the inversion rule in the development of musical intervals was observed.

3.2. Discussion

The results obtained made it possible to understand that the pedagogical structure of Sosa's book (2010) follows a progressive organization of learning, which is consistent with Pascual (2002), who stated that musical content should be presented sequentially to facilitate comprehension. In this sense, the initial emphasis on rhythm and melody reflects Willems's (2001) proposal, who considered rhythm as the foundation of musical development. Similarly, the gradual incorporation of harmony at more advanced levels demonstrates a pedagogical logic consistent with the ideas of Piston (1987), who highlighted its higher level of complexity within musical language. Furthermore, the presence of didactic resources such as the inversion rule revealed an approach focused on conceptual understanding, moving away from traditional models based solely on repetition (Hemsey de Gainza, 2002). This aspect is related to Ausubel's (1983) theory of meaningful learning, which emphasizes the importance of connecting new knowledge with prior cognitive structures. On the other hand, the progressive organization of content in the text can also be linked to contemporary approaches in music education. In this regard, Juntunen (2016) emphasized that starting from bodily experiences facilitates the understanding of rhythm, while Welch (2015) noted that the gradual use of the voice allows students to develop musical skills more naturally. This perspective is reinforced by Gardner (1983), who recognized that musical intelligence develops through structured and continuous processes. Regarding the articulation between theory and practice, the results were consistent with Elliott (1995), who proposed that musical learning should be constructed through active experience. Likewise, Sloboda (2005) highlighted the importance of deliberate practice as a key element in the development of musical skills. In the same way, it was observed that Sosa's method promotes student autonomy, which aligns with Hargreaves (2012), who stated that music education contributes to the development of self-regulation. Additionally, Hallam (2010) emphasized that musical learning positively influences

cognitive and emotional development. However, it is important to note that this study presented certain limitations, as the analysis focused solely on a single work, which restricts the possibility of generalizing the results to other music teaching methods. In this regard, future research could expand the study by comparing different pedagogical approaches. Finally, the findings allow us to affirm that Sosa's method aligns with contemporary pedagogical approaches, standing out as a relevant alternative for teaching musical language in current educational contexts.

IV. Conclusions

Based on the analysis conducted, it was determined that the book *Basic Concepts of Musical Language* by Sosa (2010) presents a clear and progressive pedagogical organization, which facilitates students' gradual understanding of the content. This made it possible to achieve the objective of the study, demonstrating that the analyzed method significantly contributes to the process of musical literacy. Likewise, it was observed that the distribution of content around rhythm, melody, and harmony promotes balanced learning, as it allows progression from basic notions to more complex concepts in an organized manner. Similarly, it was identified that the use of teaching strategies, such as the inversion rule and practical exercises, helps students better understand musical concepts, overcoming traditional approaches focused solely on repetition. On the other hand, it was evident that the method proposed by Sosa can foster the development of student autonomy by promoting more active and progressive learning. Finally, it was recognized that the study presented certain limitations due to its focus on a single work; therefore, it is suggested that future research analyze and compare other music teaching methods in order to expand knowledge in this field.

Ethics Statement

As the author of this review article, I declare that the work has been carried out under the strictest principles of academic integrity. Special care has been taken to ensure that each analysis of the book is objective and respectful of Roberto Sosa's original perspective. My commitment is that the interpretation presented here faithfully reflects the content of the work, avoiding any form of personal bias that could distort its pedagogical proposal. Likewise, I guarantee that this review process adheres to the principles of transparency and respect for the intellectual property of all cited authors. In the process of moving toward the testing phase of this method within the school band of Juli, I ensure that the use of the material remains purely educational and scientific. My intention is that the technical analysis of the book serves as a solid ethical foundation for student learning, always safeguarding the rights of all individuals involved in the research.

Acknowledgments

I would like to express my very special gratitude to my parents, whose unconditional support, patience, and constant encouragement have been the driving force that

motivated me to move forward and complete this work, I also wish to extend my sincere appreciation to the educational community of IES María Asunción Galindo, as they were the fundamental inspiration that awakened in me the interest in validating this method as a proposal for change and artistic growth in our beloved Juli.

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Influence of Music on the Affective Development of Students At IES Telésforo Catacora-Juli

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ABSTRACT

Music is a vehicle of expression and a modulating factor in the lives of adolescents. Objective: To determine the influence of music on the affective development of students at Telésforo Catacora Secondary Educational Institution in Juli during the 2024 academic period. Methodology: The study was developed under a quantitative basic research approach with a non-experimental, correlational, and cross-sectional design. The total population consisted of 118 students, from which a representative sample of 90 students was selected through probabilistic sampling. Data collection was carried out using the survey technique, applying a structured questionnaire that was previously subjected to rigorous validity and reliability processes. Results: Inferential results analyzed using Spearman's Rho statistical test showed a significant positive correlation of 0.219 ($p = 0.038$) between music and affective development. This influence was confirmed in all specific affective dimensions: emotions (Rho = 0.235), mood (Rho = 0.208), affective tone (Rho = 0.226), and feelings (Rho = 0.211). Conclusion: Music directly and positively influences affective development. Its presence in the educational and personal environment is essential for strengthening emotional stability, mood regulation, and students' self-valuation. From an acoustic perspective, music is defined as the combination of sounds and silences over time. This is based on the manipulation of sound waves that possess physical qualities such as frequency, amplitude, and waveform (Schafer, 2013). On the other hand, Stravinsky (1942) defines music as "a certain organization of sound." In this sense, music is an organized structure that follows compositional principles such as form, texture, harmony, and melody.

Keywords: Adolescence, affective development, music.

I. Introduction

The influence of music on meaningful learning is also considered, as well as the effects it has on the individual, not only in the academic field but also in life itself and in mental health. In this research, the relationships between music and learning, music and emotions, and emotions and their impact on performance have been analyzed (Llanga Vargas & Insuasti Cárdenas, 2019). According to Barreto Ramírez (2025), music is not only one of the well-known manifestations of art, but also an emotional and cognitive process that has a direct influence on the integral development of a child. Music education offers profound and lasting benefits in people's emotional development. Musical learning and practice from an early age strengthen skills such as emotional self-regulation, empathy, and resilience, which are key elements for emotional well-being throughout life (Ruilova Chicaiza & Tapia Melo, 2025). Furthermore, music can directly influence the emotional state of the listener, becoming a key factor that modifies interaction with the sound environment and the processing of feelings. Music, as a variable in human development, directly impacts cognitive abilities by introducing a sound structure into learning processes (Avilez et al., 2025). Through the review of various sources and empirical studies, a description of scientific evidence is presented that integrates neuroscience, the study of higher psychological functions, and various musical stimuli in order to clarify the neurobiological mechanisms that help determine whether music plays an important role in the manifestation of positive and negative emotions (Cabrera, 2013). According to Rodríguez Sevillano (2020), music is sound that has been organized to affect someone. The definition of music should include the words beauty or pleasure, since it produces emotions in us. Songs are a basic element of everyday musical behavior; therefore, it is necessary for students throughout their schooling to learn many songs that provide expressive variety and stimulate their interest, becoming one of the most meaningful learning experiences in their education (Egea, 2009). The development of musical performance skills in formal education has been strongly linked to learning the conventional musical notation system. Numerous beginner-level instrumental teaching methods propose the simultaneous development of performance and reading skills (Burcet, 2010). For musical learning, it is very important to perceive and assimilate the qualities of sound in order to recognize more complex musical structures (Pinilla, 2012). In musical initiation methods known as "active methods," rhythm occupies an important place. The spontaneous musical development of children and particularly the emergence of musical rhythm are briefly reviewed. Rhythm is the essential element for children's musical awareness (Gérard, 1991). Although music may seem very close to spoken language, it is always an art. Its meaning is never conceptual in nature; rather, it is intertwined with the signifier, which is the sound construction (Vargas & María, 2010). According to Carrasco et al. (2016), music education dedicates a large part of its efforts to its development. Likewise, the impact of music education on the cognitive development of basic education students is a research topic that seeks to examine the relationship between music education and students' cognitive development in basic education (Sotomayor et al., 2023).

Musicology was first published in 1978 and is considered the scientific body of the Spanish Society of Musicology. It is mainly focused on the study of Spanish musical heritage and its different geographical and historical branches. Its lines of research cover all periods and disciplines, including articles on historical music, aesthetics, music theory, documentation, performance practice, analysis, and sociology of music (Mazuela-Anguita, 2013). According to Alvarado (1988), tradition is continuity and change. It involves an act of adherence to the past and, simultaneously, one of reinterpretation and adaptation to the changing pulses of life. Music is a reflection of the culture that creates it; it is “humanly organized sound,” emphasizing that its meaning and function are intrinsic to social and cultural contexts. Melody is the tessitura (the pitch range of sung sounds) (Guerrero, 2012). Harmony is the simultaneous combination of different sounds (chords). Harmony establishes tonality and is a crucial factor in generating musical tension and release, which is directly related to emotional response. It relates sounds according to certain affinities between them, making them sound simultaneously. The word itself, “harmony,” when analyzed etymologically, means “union” or “connection”: “harmós” (fusion) and “monos” (one) (Kupareo, 1974). Rhythm, as an infallible action of music, becomes a means for integral development because it transcends the human being through words, body expression, and emotions. As a natural expressive and sound resource, it enriches the thinking, feeling, and actions of individuals, and in this sense translates social practices, creativity, coexistence, and pleasurable enjoyment into intelligence (Herrera, 2012). According to Solorzano et al. (2026), the emotion of music is related to human emotions because it is a means of expression through rhythms, sounds, and melodies capable of communicating people’s feelings. Motivation indicates that expressiveness should be improved in music teaching-learning processes and that the inclusion of explicit elements of emotional expressiveness training is beneficial. In this regard, it has been observed that the creative work of inventing and adapting motifs from different harmonic sequences has been very rewarding for students, as evidenced in the following interview excerpts (Berrón Ruiz et al., 2017).

II. Methodology

The research adopted a positivist paradigm with a quantitative approach, being of a basic type and correlational level. The design was non-experimental and cross-sectional.

- **Population and Sample:** The total population consisted of 118 students, from which a probabilistic sample of 90 fifth-grade students was selected.
- **Techniques and Instruments:** The survey was used as the technique, and a Likert-scale questionnaire was used as the instrument, designed *ad hoc* to measure musical stimuli and affective development.

- **Statistical Analysis:** The data were processed using SPSS software, applying Spearman's Rho test for hypothesis validation with a 95% confidence level.

Place of Study: The Telésforo Catacora Secondary Educational Institution, located in the city of Juli, province of Chucuito, department of Puno, is the geographical focus of this study. The study was carried out in an educational environment in which fifth-grade secondary students participated in a creative and cultural exchange during the 2024 academic year.

Type of Research: The study is basic research, sometimes referred to as pure or theoretical research. The aim of this type of research is to provide new scientific knowledge and hypotheses about a reality without intending to modify the phenomenon studied or to find an immediate practical application. The main objective is to improve the current theoretical body of knowledge on music psychology and affective development.

Level of Research: The research is situated at the correlational–causal level. This level aims to determine the degree of relationship between two or more ideas, categories, or variables in a specific sample or context. In this particular case, the objective is to determine the direction of the influence of the independent variable on the dependent variable, as well as to establish associations.

Research Design: A cross-sectional and non-experimental design was employed:

- **Cross-sectional:** Since the data were collected at a single point in time, the design is cross-sectional. Its objective is to characterize the variables and examine how they occur and interact at a specific moment.
- **Non-experimental:** There was no intentional manipulation of the independent variable. In other words, students were not exposed to controlled laboratory stimuli; instead, the phenomena were observed in their natural environment for study.

Population: In the present study, all students enrolled in the fifth grade of secondary education at the Telésforo Catacora Secondary Educational Institution in Juli during the 2024–11 academic year constitute the population, which is accessible and limited. The population consists of $N = 118$ students of both genders. It is considered the sampling frame, since it is a recognized and institutionally registered population, whose distribution by sections is described below.

Distribution of the Fifth-Grade Student Population

Grade	Section	Number of Students
Fifth	"A"	22
Fifth	"B"	21
Fifth	"C"	19
Fifth	"D"	18
Fifth	"E"	20
Fifth	"F"	18
Total		118

Source: Own elaboration

The sample is a subset of the population of interest from which data will be collected. In order to be representative of that population, it must be carefully defined and delimited.

For this study, a probabilistic sample was selected. This method is crucial for quantitative correlational research because it ensures that all members of the population have the same probability of being selected. This allows the results to be generalized and the standard error to be calculated.

Sample Size Calculation: A statistical method for finite populations was used with a universe of 118 students (N) in order to determine the ideal sample size (n). This resulted in a margin of error of 5% (0.05) and a confidence level of 95% ($Z = 1.96$). Likewise, a condition of maximum heterogeneity was established with a similar probability of occurrence and non-occurrence ($p = q = 0.5$) to ensure the adequacy of the sample, guaranteeing the accuracy of the estimation even in the case of maximum variance.

By applying the statistical equation:

$$\frac{Z^2 * p * q * N}{E^2(N - 1) + Z^2 * p * q}$$

The calculation resulted in a sample size of $n = 90$ students.

Variables Operationalization

Variable	Conceptual Definition	Dimensions	Indicators	Measurement Scale
V.I. music	It is understood as the aesthetic organization of sounds and silences over time. It involves the interaction of sound elements that, when perceived by the student, have the capacity to evoke sensory and cognitive responses.	1. Melody	• Perception of the succession of notes	Ordinal
			• Identification of melodic structures	
			• Recognition of tones	
		2. Harmony	• Perception of simultaneous chords	
			• Sense of sound balance	
			• Distinction of consonances	
		3. Rhythm	• Following the musical pulse	
			• Reaction to rhythmic accent	
			• Perception of meter/tempo	
V.D. affective development	It is the comprehensive process through which the adolescent constructs his or her emotional world. It includes the ability to recognize momentary emotions, maintain mood states, and consolidate deeper feelings toward oneself and others.	1. Emotions	• Experience of positive emotions (Joy)	Ordinal
			• Management of negative emotions (Anger)	
			• Regulation in the face of fear	
		2. Mood	• Tendency toward optimism	
			• Tendency toward pessimism	
			• Mood stability	
		3. Affective tone	• General positive disposition	
			• Levels of euphoria or exaltation	
			• Capacity for empathy	
		4. Feelings	• Practice of solidarity	
			• Emotional clarity (vs. anomie)	

III. Results And Discussion

3.1. Results

Descriptive Results – General Objective

Note. Data obtained from the applied questionnaire. Own elaboration.

Shows the overall relationship between the use of music and affective development. It is observed that, among students with a high level of musical influence, the largest percentage (48.3%) presents a high level of affective development, suggesting a positive trend. In contrast, students with a low level of musical influence are mostly concentrated in a low level of affective development (71.0%), showing a clear decrease in affective capacities when music is absent or undervalued. The descriptive data indicate that music acts as a protective and enhancing factor; as its presence and influence increase, students tend to achieve higher levels of affective development.

Table 1

Table title

Variables	Category 1	Category 2	Category 3
MÚSIC	Melody	Harmony	Rhuthm
AFFECTIVE DEVELOPMENT	Emotions	State of mind	Feelings

Note. Explain or provide the information about the table.

Table 2

Level of influence of music on students' affective development.

Level of Music Influence	Low Affective Development	Medium Affective Development	High Affective Development	Total
High	9 (31.0%)	6 (20.7%)	14 (48.3%)	29 (100%)
Medium	10 (33.3%)	15 (50.0%)	5 (16.7%)	30 (100%)
Low	22 (71.0%)	7 (22.6%)	2 (6.4%)	31 (100%)
Total	41 (45.6%)	28 (31.1%)	21 (23.3%)	90 (100%)

Note. Used to describe the content of the figure.

The data presented in Table 2 show the overall relationship between musical influence and affective development. It is highlighted that in the group of students with a high level of musical influence, the highest percentage (48.3%) presents a high level of affective development, indicating a positive tendency.

On the other hand, students with a low level of musical influence are mainly concentrated in a low level of affective development (71.0%), showing a marked reduction in affective capacities when music is absent or minimally valued.

The descriptive results suggest that music acts as a protective and enhancing factor; as its presence and influence increase, students tend to show higher levels of affective development.

Descriptive Results

Table 3

Influence of music on students' emotions

Level of Musical Influence	Low Emotional Level	Medium Emotional Level	High Emotional Level	Total
High	8 (27.6%)	8 (27.6%)	13 (44.8%)	29 (100%)
Medium	9 (30.0%)	16 (53.3%)	5 (16.7%)	30 (100%)
Low	23 (74.2%)	6 (19.4%)	2 (6.4%)	31 (100%)
Total	40 (44.4%)	30 (33.3%)	20 (22.2%)	90 (100%)

Regarding the emotional dimension (Table 3), it is observed that 44.8% of students with a high level of musical influence achieve a high level in emotional management. In contrast, the group with a low level of musical influence shows a concerning 74.2% of students with a low emotional level. This indicates that music is a key tool for emotional regulation; without its influence, the majority of students demonstrate difficulties in emotional development and regulation.

Descriptive Results

Table 4

Influence of music on students' mood

Level of Musical Influence	Level of Musical Influence	Level of Musical Influence	Level of Musical Influence	Level of Musical Influence
High	10 (34.5%)	7 (24.1%)	12 (41.4%)	29(100%)
Medium	8 (26.7%)	17 (56.7%)	5 (16.6%)	30(100%)
Low	20 (64.5%)	8 (25.8%)	3 (9.7%)	31(100%)
Total	38 (42.2%)	32 (35.6%)	20 (22.2%)	90(100%)

Table 4 shows that 41.4% of students exposed to a high level of music report a high mood level (optimistic/positive). However, in the low influence group, a low mood

level predominates (64.5%). It is observed that music functions as a mood enhancer or stimulant; its absence is associated with lower or negative mood states in most cases.

Descriptive Results

Table 5

Influence of music on affective tone

Level of Musical Influence	Low Affective Tone	Medium Affective Tone	High Affective Tone	Total
High	7 (24.1%)	9 (31.0%)	13 (44.9%)	29(100%)
Medium	11 (36.7%)	14 (46.6%)	5 (16.7%)	30(100%)
Low	21 (67.7%)	8 (25.8%)	2 (6.5%)	31(100%)
Total	39 (43.3%)	31 (34.5%)	20 (22.2%)	90(100%)

Regarding affective tone (Table 5), the results are consistent: 44.9% of students with high musical influence present a high affective tone. In contrast, 67.7% of students with low musical influence are located at the low level. Affective tone, understood as a stable emotional baseline, is significantly strengthened by the presence of music in students' lives.

Descriptive Results

Table 6

Influence of music on students' feelings

Level of Musical Influence	Low Feelings	Medium Feelings	High Feelings	Total
High	8 (27.6%)	7 (24.1%)	14 (48.3%)	29(100%)
Medium	10 (33.3%)	15 (50.0%)	5 (16.7%)	30(100%)
Low	20 (64.5%)	9 (29.0%)	2 (6.5%)	31(100%)
Total	38 (42.2%)	31 (34.5%)	21 (23.3%)	90(100%)

Note. Data obtained from the applied questionnaire. Own elaboration.

Table 6 presents results regarding the dimension of feelings (self-esteem, self-perception). It is observed that in the group with a high level of musical influence, nearly half of the students (48.3%) report a high level of feelings.

This situation changes significantly in the low-influence group, where low feelings predominate (64.5%), and only 6.5% reach the high level.

The descriptive data reveal a clear trend: students who integrate music into their daily lives report better self-perception and more positive feelings toward themselves compared to those with limited musical exposure.

Inferential Results

Table 7

Correlation between music and affective development

Variables	Statistic	Value	Sig. (2-tailed)
Music – Affective Development	Spearman's Rho correlation coefficient	0.219	0.038
	N	90	

Note. Own elaboration.

The Spearman's Rho test for the general objective yielded a positive correlation coefficient of 0.219 with a p-value of 0.038.

Since the significance value is within the expected range ($p < 0.05$), the null hypothesis is rejected and the alternative hypothesis is accepted.

The result statistically confirms that there is a significant positive relationship between music and affective development. This means that the use of music contributes to improving students' overall affective development, although the strength of the relationship is moderate.

Inferential Results

Table 8

Correlation between music and emotions

Variables	Statistic	Value	Sig. (2-tailed)
Music – Emotions	Spearman's Rho correlation coefficient	0.235	0.026
	N	90	

Note. Own elaboration.

For the first specific objective, the inferential analysis shows a coefficient of 0.235 with a significance value of 0.026.

This value is lower than 0.05, demonstrating a significant relationship. It is confirmed that music positively influences the emotional dimension, helping students to regulate and express their emotions more effectively.

Inferential Results

Table 9

Correlation between music and mood

Variables	Statistic	Value	Sig.(2-tailed)
Music – Mood	Spearman's Rho correlation coefficient	0.208	0.049
	N	90	

Note. Own elaboration.

The statistical test for mood shows a correlation of 0.208 and a significance of 0.049.

Being just below the threshold of 0.05, it confirms the existence of a significant relationship. Although the significance is borderline, it is sufficient to state that music impacts students' mood, promoting more optimistic and positive attitudes.

Inferential Results

Table 10

Correlation between music and affective tone

Variables	Statistic	Value	Sig. (2-tailed)
Music – Affective Tone	Spearman's Rho correlation coefficient	0.226	0.032
	N	90	

Note. Own elaboration.

Regarding affective tone, a coefficient of 0.226 with a p-value of 0.032 was found.

This result is clearly significant ($p < 0.05$). Music shows a direct influence on students' affective tone, strengthening their emotional stability and overall affective level.

Inferential Results

Table 11

Correlation between music and feelings

Variables	Statistic	Value	Sig.(2-tailed)
Música - Sentimientos	Spearman's Rho correlation coefficient	0.211	0.045
	N	90	

Note. Own elaboration.

Finally, for the feelings dimension, the correlation was 0.211 with a significance of 0.045.

The specific hypothesis is confirmed since the p-value is lower than 0.05. It is concluded that music influences students' feelings, such as self-esteem and self-perception, making it a relevant factor in their comprehensive development.

3.2. Discussion

The results obtained in the present research show that there is a positive and significant relationship between music and the affective development of students, evidenced by Spearman's correlation coefficient ($\rho = 0.219$; $p = 0.038$). These findings coincide with what was proposed by Cabrera (2013), who states that music has the capacity to directly influence human emotions, since musical stimuli activate psychological and neurobiological processes that facilitate emotional expression and regulation. In this sense, the results of the study confirm that music functions as an element that strengthens affective development in students. Similarly, the results obtained in the emotion dimension ($\rho = 0.235$; $p = 0.026$) agree with what was stated by Rodríguez Sevillano (2020), who affirms that music is an organized sound capable of generating pleasure and producing emotions in people. This explains why students who have greater contact with music show better levels of emotional regulation, since musical experience facilitates the identification, expression, and management of their emotional states. Likewise, the results related to the dimensions of mood, affective tone, and feelings are also consistent with what was proposed by Barreto Ramírez (2025), who points out that music is not only an artistic manifestation but also an emotional and cognitive process that contributes to the comprehensive development of students. According to this author, musical practice strengthens socio-emotional skills such as empathy, self-esteem, and emotional self-regulation, aspects that are reflected in the results obtained in this research. Consequently, the findings of this study support theories that highlight the importance of music in emotional and affective development during adolescence, demonstrating that its integration into the educational context can significantly contribute to the emotional well-being and holistic development of students.

IV. Conclusions

It was determined that a significant and positive influence exists between music and the affective development of students at the IES Telesforo Catacora – Juli, 2024. This conclusion is based on Spearman's Rho statistical test, which yielded a coefficient of 0.219 and a significance level of $p=0.038$ ($p<0.05$), demonstrating that the active presence of music in students' lives directly contributes to improving their well-being and general affective capacity. It was established that music significantly influences students' emotions. Statistical results reported a Spearman's Rho correlation of 0.235 with a significance of $p=0.026$ ($p<0.05$), confirming that musical stimulus acts as an

effective regulator allowing adolescents to identify, process, and express their emotions in a healthier way.

Ethics Statement

The present research was carried out in accordance with the fundamental ethical principles of scientific research. Throughout the entire process, transparency, academic honesty, and respect for the rights of the participants were ensured.

Likewise, the corresponding authorization was requested from the educational institution, and the students were informed about the purpose of the study, ensuring their voluntary participation. The data collected through the questionnaire were used exclusively for academic and research purposes, maintaining the confidentiality and anonymity of the participants.

Similarly, the principles of scientific integrity, truthfulness in the management of information, and the proper use of bibliographic sources were respected, avoiding any form of plagiarism or data manipulation.

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Applied Sciences and Institutional Management



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ABSTRACT

Groundwater constitutes the main source of water supply for human consumption in rural communities; therefore, its quality is essential for public health. The aim of this study was to analyze nitrate concentrations in groundwater used for human consumption in the Tuni Grande community, Taraco district, Puno, Peru. Ten artisanal wells were evaluated during the dry season (october 2023) and the wet season (march 2024), and physicochemical parameters were analyzed using standardized methods. The results revealed elevated nitrate concentrations in both periods, with mean values of 102.30 mg/L during the dry season and 85.96 mg/L during the wet season, significantly exceeding the maximum permissible limit of 50 mg/L established by current regulations. Nitrate concentrations ranged from 9.62 to 186.30 mg/L in the dry season and from 7.55 to 158.40 mg/L in the wet season. Additionally, 80% of the evaluated wells exceeded the permissible limit in both periods, indicating a persistent contamination pattern. Although a partial decrease was observed during the wet season, it was not sufficient to ensure compliance with water quality standards. It is concluded that groundwater in the Tuni Grande community is affected by nitrate contamination exceeding permissible limits, representing a potential risk to public health.

Keywords: Artisanal wells, groundwater, maximum permissible limits, nitrate, public health.

I. Introduction

Groundwater constitutes one of the main sources of water supply for human consumption, irrigation, and other productive activities in rural areas of Peru, especially in regions where access to treatment systems is limited (Autoridad Nacional del Agua, 2021). However, the quality of this resource is increasingly threatened by the presence of contaminants, among which nitrates stand out, mainly derived from the intensive use

of nitrogen-based fertilizers, agricultural and livestock activities, and deficiencies in basic sanitation systems (Rodríguez & Gutiérrez, 2019; World Health Organization, 2017).

At the global level, nitrate contamination in groundwater represents one of the most significant environmental problems (Rodríguez et al., 2012). It is closely linked to the increasing use of nitrogen fertilizers (Singh & Craswell, 2021), affecting both groundwater and surface water bodies. Anthropogenic activities have increasingly impacted groundwater quality, raising growing concern (Verma et al., 2023; Atabati et al., 2022; Sheng et al., 2023). The excessive use of fertilizers and manure in agriculture contributes to nitrogen leaching (Pasupuleti et al., 2022; Kyte et al., 2023), while industrial and agricultural pollutants further degrade water quality (Mancilla et al., 2021). This issue persists particularly in countries with intensive agricultural practices and high nitrogen surpluses (Zhu et al., 2023; Xie et al., 2023).

Nitrates pose a significant risk to human health, especially when consumed through drinking water with elevated concentrations. Their presence in groundwater has been associated with serious health effects such as methemoglobinemia (blue baby syndrome), thyroid disorders, and an increased risk of cancer due to prolonged exposure (Selvam et al., 2023; Verma et al., 2023; Das et al., 2023). In addition, nitrates have harmful effects on aquatic ecosystems, with eutrophication being one of the most critical consequences. This process, driven by excessive nutrient inputs such as nitrogen, promotes uncontrolled algal growth, deteriorating water quality and threatening aquatic biodiversity (Pérez et al., 2013).

In the district of Taraco, province of Huancané, the Tuni Grande community relies primarily on groundwater to meet its domestic needs, constituting its main source of water supply. However, there is limited systematized information regarding nitrate concentrations in these sources, as well as their compliance with maximum permissible limits established by national and international regulations for drinking water (Pacheco & Cabrera, 2003; World Health Organization, 2017).

The aim of this study is to analyze nitrate concentrations in groundwater used for human consumption in the Tuni Grande community, Taraco district, Puno, Peru.

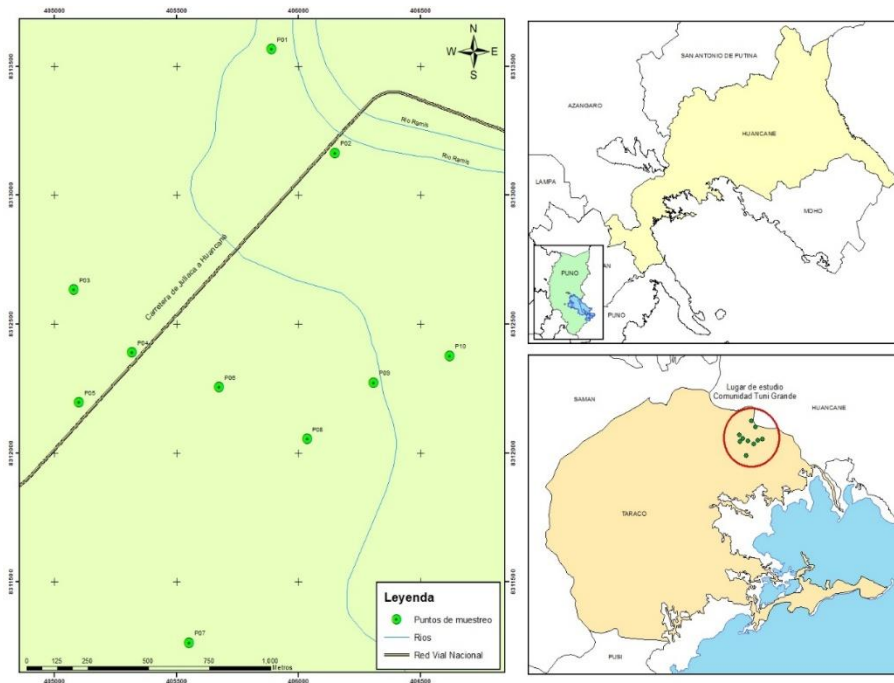
II. Methodology

2.1. Study Area

The study was conducted in the Tuni Grande community, located in the Taraco district, Huancané province, Puno department, Peru, where the water supply for human consumption primarily depends on artisanal wells. Figure 1 shows the location of the sampling points evaluated in this study.

Figure 1

Location map of the sampling points



2.2. Study Design and Type of Study

The research was descriptive and comparative in nature, with a non-experimental, cross-sectional design, aimed at analyzing nitrate concentrations in groundwater and their compliance with current national and international regulations (Hernández Sampieri et al., 2014).

2.3. Population and Sample

The population consisted of the artisanal wells located in the Tuni Grande community. The sample comprised ten wells selected through non probability convenience sampling, considering their use for human consumption and accessibility.

2.4. Sample Collection

Water samples were collected in October 2023 and March 2024, corresponding to the dry and wet seasons (De la Cruz, 2021), following the guidelines for groundwater sampling and preservation established by the American Public Health Association (APHA et al., 2017). Polyethylene bottles previously conditioned were used, and the samples were stored under refrigeration until laboratory analysis.

2.5. Physicochemical Analysis

In situ parameters such as pH, temperature, total dissolved solids, and electrical conductivity were measured using a calibrated portable multiparameter device (HI98130S pH/EC/TDS/°C meter, Hanna Instruments). Groundwater samples were collected following established protocols for preservation and transport. Subsequently, they were analyzed at the Sur E.I.R.L. laboratory using the SMEWW 24th edition method for nitrate determination (Method 4500-NO₃⁻ C, second-derivative ultraviolet spectrophotometric method).

2.6. Data Analysis

The collected data were systematized and analyzed using descriptive statistics, including mean, minimum, and maximum values. The results were then compared with the maximum permissible limits established by Supreme Decree No. 031-2010-SA (MINSA, 2010) and the guidelines of the World Health Organization (WHO, 2017). Statistical analysis was performed using SPSS version 27 for Windows.

III. Results and Discussion

3.1. Results

The general characteristics of the physicochemical parameters of groundwater in the Tuni Grande community, evaluated during the dry season (October 2023) and the wet season (March 2024), showed considerable variability in the recorded values across the different sampling points in both periods, as presented in Tables 1 and 2.

Table 1

Statistical summary of in situ physicochemical parameters during the dry season – 2023

Statistic	pH	Temperature (°C)	Electrical Conductivity (μS/cm)	Total Dissolved Solids (mg/L)	Nitrate (mg/L)
Minimum	6.71	13.40	590.00	299.40	9.62
Maximum	7.70	18.90	6260.00	3113.76	186.30
Mean	7.10	15.42	3215.00	1601.79	102.30
Standard Deviation	0.31	1.62	1833.74	912.03	56.82

Source. Barrantes, A. (2025).

Table 2

Statistical summary of in situ physicochemical parameters during the wet season – 2024

Statistic	pH	Temperature (°C)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Nitrate (mg/L)
Minimum	6.79	13.80	750.00	379.24	7.55
Maximum	7.64	15.40	6370.00	3173.64	158.40
Mean	7.15	14.60	3216.00	1620.75	85.96
Standard Deviation	0.28	0.51	1725.06	860.21	47.49

Fuente. Barrantes, A. (2025).

The average nitrate concentration was higher during the dry season than in the wet season, showing a partial decrease during the rainy period. A greater dispersion of data was also observed during the dry season, reflected in the wider range between minimum and maximum values, particularly at sampling points with elevated concentrations.

pH values remained within a slightly acidic to neutral range in both periods, with similar variations between the dry and wet seasons. Similarly, water temperature showed a narrow range, with slightly higher values during the dry season.

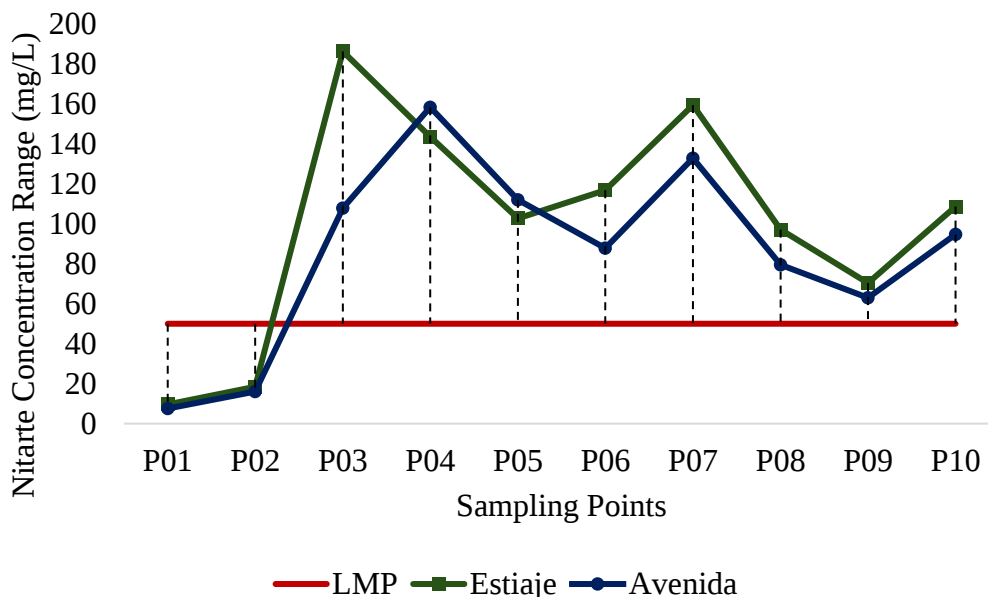
Electrical conductivity and total dissolved solids exhibited elevated values at several sampling points, especially during the dry season. However, a slight increase was observed at some points during the wet season, maintaining high spatial variability in both periods.

Overall, the minimum and maximum values of the evaluated physicochemical parameters showed similar patterns in both sampling campaigns, highlighting the persistence of heterogeneous chemical conditions in the aquifer throughout the year.

Nitrate concentrations recorded in the artisanal wells of the Tuni Grande community showed significant variations between the two sampling periods evaluated. In general terms, values were higher during the dry season than in the wet season, indicating a partial reduction during the rainy period; however, they did not reach levels consistent with drinking water quality standards.

Figure 2

Nitrate concentration during the dry and wet seasons



Source: Barrantes, A. (2025).

During the dry season, nitrate concentrations ranged from 9.62 to 186.30 mg/L, while in the wet season they ranged from 7.55 to 158.40 mg/L. The highest values were recorded at sampling points P03, P04, P05, P06, and P07 in both periods, all of which exceeded the maximum permissible limit of 50 mg/L established by the World Health Organization and current Peruvian regulations.

In percentage terms, 80% of the evaluated wells exceeded the maximum permissible limit in both sampling periods, indicating a persistent pattern of contamination in the study area. Only sampling points P01 and P02 showed concentrations within acceptable limits during both campaigns.

3.2. Inferential Analysis

Given that nitrate concentration data followed a normal distribution, a one-sample t-test was applied to assess compliance with current regulations by comparing the mean concentrations with the maximum permissible limit of 50 mg/L established for drinking water.

During the dry season, the mean concentration was 102.30 mg/L, which was significantly higher than the permissible limit ($p = 0.017$). Similarly, during the wet

season, the mean concentration was 85.97 mg/L, also significantly exceeding the regulatory limit ($p = 0.040$).

These results indicate a statistically significant non-compliance with drinking water quality standards in both sampling periods.

3.3. Discussion

The nitrate concentration in drinking water should not exceed 50 mg/L NO_3^- for it to be considered safe for human consumption (Dzwairo et al., 2006). However, the results showed that 80% of the evaluated wells exceeded the maximum permissible limits for drinking water quality according to national standards (DIGESA/Ministerio de Salud, 2011), and according to WHO (2017), only sampling points P01 and P02 met the established limits.

The persistence of elevated concentrations in most of the evaluated wells suggests the existence of continuous sources of nitrate input into the aquifer. Similar studies indicate that nitrate contamination in groundwater is more frequently associated with anthropogenic sources, such as the intensive use of nitrogen-based fertilizers and the infiltration of domestic or agricultural wastewater (Kross et al., 1993; Rivett et al., 2008). Spalding and Exner (1993) stated that nitrate behavior in groundwater is also related to hydrogeological characteristics of the aquifer, land use, and water residence time.

The partial reduction in concentrations during the wet season suggests a dilution effect associated with increased water input; however, this phenomenon is not sufficient to restore conditions compatible with water quality standards. Consequently, nitrate contamination persists throughout the year, representing a continuous risk for the population relying on these wells.

From a public health perspective, Selvam et al. (2023) reported that nitrate concentrations exceeding recommended limits constitute a risk factor, particularly for vulnerable populations such as children and older adults, due to their association with diseases such as methemoglobinemia and other related disorders.

IV. Conclusions

The study demonstrated that groundwater from artisanal wells in the Tuní Grande community presents nitrate concentrations significantly higher than the maximum permissible limit of 50 mg/L established for human consumption, in both the dry and wet seasons. Statistical analysis confirmed that the mean values significantly exceed current regulations, indicating systematic non-compliance with water quality standards and representing a potential risk to the health of the local population.

It is recommended to implement integrated water resource management strategies aimed at protecting groundwater sources, controlling the use of fertilizers, improving

rural sanitation systems, and ensuring continuous water quality monitoring. These actions are essential to guarantee access to safe water in the Tuni Grande community and to reduce the environmental and health risks associated with nitrate contamination.

Ethics Statement

The research on nitrate in groundwater in the Tuni Grande community, Taraco, Peru, complied with all necessary ethical requirements throughout the entire research process and adhered to principles of transparency and respect for the rights of all stakeholders involved.

Acknowledgments

The author expresses gratitude to the Tuni Grande community for granting access to conduct this research

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Internal Control as a Mechanism for Effective Administrative Management in the District Municipalities of Juli and Pomata, Puno Region, 2023–2024

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ABSTRACT

This study evaluated the impact of the internal control system on administrative management in the district municipalities of Juli and Pomata, located in the Puno region, Peru, during the 2023–2024 period. The research was conducted in response to the need to determine whether internal control is implemented as an effective management tool or merely as a formal compliance requirement within local government institutions. A quantitative approach was applied, using a non-experimental, descriptive-analytical design. Data were collected through a structured questionnaire administered to 40 administrative staff members from the main offices of both municipalities. The results show that 44.26% of respondents perceive an initial level of implementation of the internal control system, while 53.58% report that its level of compliance remains inadequate. In addition, several weaknesses were identified, including limited institutional dissemination, insufficient risk assessment practices, outdated management instruments, weak segregation of duties, inadequate supervision, and unfavorable working conditions. The study concludes that strengthening the internal control system is essential to improve administrative efficiency, enhance decision-making processes, and increase transparency in municipal management. These findings highlight the need for continuous improvement strategies to ensure that internal control functions as a practical governance mechanism rather than a formal requirement.

Keywords: Administrative management; internal control; local governments; municipalities; transparency

I. Introduction

In public administration, internal control has gradually become a core managerial practice rather than a merely procedural requirement. Its role extends beyond

supervision because it helps public entities align operations, resources, and decisions with institutional goals while promoting legality, transparency, and accountability (Congress of the Republic of Peru, 2006; Office of the Comptroller General of the Republic, 2019; Office of the Comptroller General of the Republic, 2024a).

Peruvian regulation supports this broader understanding. Law No. 28716 established that internal control in state entities must be organized, implemented, and assessed as part of institutional functioning. In the same direction, Directive No. 006-2019-CG/INTEG specifies that internal control should contribute to management, risk prevention, and continuous improvement in administrative processes (Congress of the Republic of Peru, 2006; Office of the Comptroller General of the Republic, 2019).

The current normative framework has also been updated several times in recent years, which shows that internal control is regarded as a living system that must adapt to new public management demands. The modifications approved in 2020, 2021, 2023, and 2024 aimed to refine implementation criteria, clarify responsibilities, and reinforce the link between internal control and managerial performance (Office of the Comptroller General of the Republic, 2020; Office of the Comptroller General of the Republic, 2021; Office of the Comptroller General of the Republic, 2023; Office of the Comptroller General of the Republic, 2024a).

From this perspective, internal control helps prevent process failures, anticipate risks, safeguard public resources, and improve institutional response capacity. It is therefore not reasonable to treat it as an exclusive task of control offices, because its effective operation depends on the commitment of managers, heads of offices, and public servants across the organization (Pacheco Barreto, 2023; Huimán Yerrén, 2022).

Recent evidence from local governments confirms this connection. In the District Municipality of Malvas, Ramírez-Gonzales et al. (2024) found a positive and significant relationship between internal control and administrative management, identifying that weaknesses in the control system were associated with shortcomings in planning, organization, direction, and administrative monitoring. Similarly, in the Provincial Municipality of Azángaro, Ccaza Cari et al. (2023) reported that the internal control environment, risk assessment, communication, and supervision were statistically associated with administrative management performance.

A comparable pattern has been observed in other municipal settings. Saavedra Licera (2023) reported that in the Provincial Municipality of Pallasca, internal control remained closely tied to administrative management, especially when institutional oversight, updated management tools, and clear procedures were present. These findings suggest that, in municipalities, internal control is not an abstract concept but an operational condition for institutional order and service delivery.

Administrative management, in turn, is the practical framework through which public entities coordinate people, procedures, information, and resources. When this

framework is weak, decision-making becomes slower, resource allocation loses consistency, and service quality tends to deteriorate. In local governments, these difficulties are often more visible because municipalities work in direct contact with citizens and must respond to concrete needs under financial and organizational constraints (Córdova Chirinos et al., 2022; Huerta Morales, 2025).

During the Covid-19 period, municipal management in Peru revealed important structural tensions. Córdova Chirinos et al. (2022) observed that many local governments faced severe coordination and planning problems due to insufficient institutional preparation. That context made it evident that administrative management requires not only formal organizational charts but also strong internal control practices capable of sustaining continuity, supervision, and decision-making in critical situations.

Along the same line, the literature points out that weaknesses in internal control can affect budget execution, procedural consistency, and citizen trust. Pacheco Barreto (2023) noted that administrative management becomes stronger when the five components of internal control are not treated separately but are integrated into daily operations. Huimán Yerrén (2022) also argued that the internal control system should be understood as part of public management itself because it reduces vulnerabilities and supports institutional performance.

In municipal environments, these challenges are even more sensitive because the public often evaluates local government performance through visible outputs such as service timeliness, document processing, public works execution, and administrative responsiveness. If internal control is weak, the problem is not only organizational. It also affects the social perception of legitimacy and the municipality's ability to provide reliable public services (Córdova Chirinos et al., 2022; Ramírez-Gonzales et al., 2024; Saavedra Licera, 2023).

In the municipalities of Juli and Pomata, the issue under study is reflected in a set of recurrent administrative shortcomings. The draft version of this research already identified low institutional dissemination of internal control, weak diagnostic practices, outdated management instruments, limited segregation of duties, and insufficient supervision. These problems suggested that internal control was operating at an incipient level and that its contribution to administrative management was still limited.

For that reason, the present study focused on evaluating the internal control system and its incidence on administrative management in the district municipalities of Juli and Pomata, Puno region, during 2023–2024. More specifically, it sought to identify the level of implementation, assess compliance, and recognize the main factors that constrain effective municipal management.

II. Methodology

The research was conducted in the district municipalities of Juli and Pomata, both located in the Puno region. A quantitative approach was adopted, combined with an applied scope and a non-experimental design, since the study aimed to describe and assess the state of internal control and its incidence on administrative management without manipulating the variables under examination.

The study population consisted of administrative staff members from the two municipalities. The sample included 40 public servants, distributed into 20 workers from the Municipality of Juli and 20 workers from the Municipality of Pomata. The original study indicated that sample size was estimated on the basis of a finite population criterion and that the participants were selected through systematic random sampling.

Data were collected through a structured questionnaire designed to gather staff perceptions regarding the implementation of the internal control system, administrative management practices, risk assessment, institutional communication, supervision mechanisms, and personnel performance. The instrument allowed the researcher to identify both quantitative tendencies and specific weaknesses within the municipalities.

The collected information was processed through tabulation in Excel and percentage-based analysis. For interpretation, the descriptive method was used to characterize the state of internal control and administrative management; the analytical method was applied to examine the main observed deficiencies and their possible causes; and the deductive method supported the formulation of conclusions derived from the study findings.

III. Results and Discussion

3.1. Results

The findings showed that the level of internal control implementation in the municipalities under study remained mostly at an initial stage. During 2023 and 2024, 44.26% of respondents reported that implementation was at an initial level, 36.62% considered it intermediate, 13.63% viewed it as non-existent, and only 5.48% considered it advanced. These results suggest that the internal control system is still in a developmental phase and that its actions have not yet reached a fully consolidated level in the analyzed entities.

Table 1

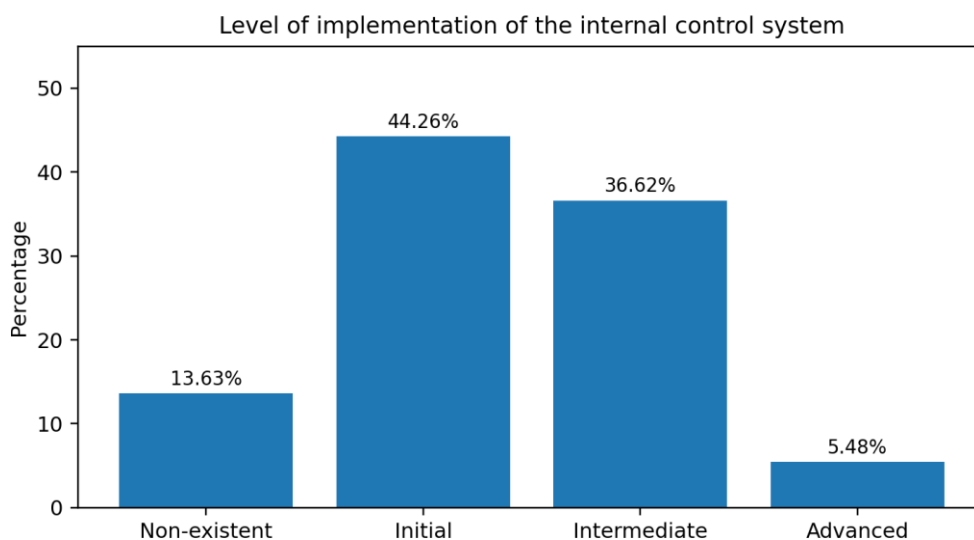
Level of implementation of the internal control system for effective administrative management

Item	Juli 2023	Juli 2024	Pomata 2023	Pomata 2024	Total %
Non-existent	2	2	3	3	13.63%
Initial	9	9	8	9	44.26%
Intermediate	8	8	8	7	36.62%
Advanced	1	1	1	1	5.48%
Total	20	20	20	20	100.00%

Note. Data were derived from the structured questionnaire administered to administrative staff in the municipalities of Juli and Pomata, 2023–2024.

Figure 1

Level of implementation of the internal control system



Note. The figure presents the percentage distribution of respondents' perceptions regarding the level of implementation of the internal control system.

Regarding compliance with internal control for effective management, 53.58% of respondents stated that the system was not being complied with, 36.97% reported that it was complied with, and 9.45% indicated that they did not know or did not answer. This pattern reflects a predominantly critical perception of the way the system actually operates and confirms that implementation remains more declarative than fully embedded in municipal routines.

Table 2

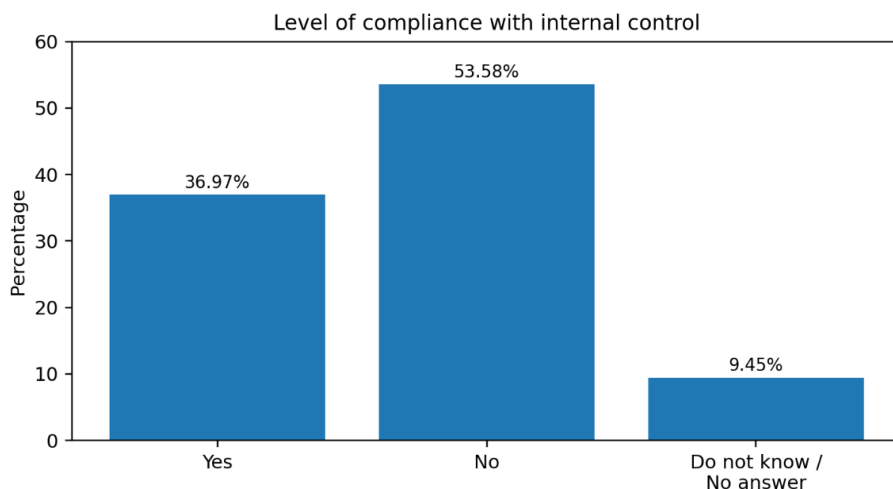
Level of compliance with internal control for effective administrative management

Item	Juli 2023	Juli 2024	Pomata 2023	Pomata 2024	Total %
Yes	8	7	7	8	36.97%
No	10	11	11	10	53.58%
Do not know / no answer	2	2	2	2	9.45%
Total	20	20	20	20	100.00%

Note. Data were derived from the structured questionnaire administered to administrative staff in the municipalities of Juli and Pomata, 2023–2024.

Figure 2

Level of compliance with internal control



Note. The figure summarizes the perception of municipal staff regarding compliance with the internal control system in the municipalities evaluated.

Beyond percentages, the survey revealed specific administrative weaknesses. Among the most recurrent problems were poor institutional dissemination of internal control, lack of diagnostic assessments, outdated planning and management documents, limited risk control practices, inadequate segregation of duties, insufficient formal access controls, lack of periodic staff evaluation, weak internal communication, and limited monitoring of compliance. The data also suggested shortcomings in personnel recruitment, scarce specialized training, insufficient staffing, and deficient working conditions.

3.2. Discussion

The results support the argument that internal control remains a decisive factor for administrative management in the municipalities of Juli and Pomata, although its current effect is restricted by incomplete implementation. The predominance of an initial implementation level and the high proportion of respondents who perceived non-compliance indicate that the control system has not yet reached the level of institutional maturity required to consistently support administrative effectiveness (Office of the Comptroller General of the Republic, 2019; Office of the Comptroller General of the Republic, 2024a).

These findings are consistent with recent studies in Peruvian municipalities. Ramírez-Gonzales et al. (2024) also observed a positive relationship between internal control and administrative management, which means that when control mechanisms are weak, planning, organization, supervision, and managerial response tend to weaken as well. Likewise, Ccaza Cari et al. (2023) found that the control environment, risk assessment, and supervision were key dimensions associated with administrative performance in municipal government.

In Juli and Pomata, one of the most critical issues was the absence of systematic diagnostic practices and follow-up mechanisms. This is particularly relevant because internal control only becomes meaningful when deficiencies are identified in time and converted into corrective action. The recent literature stresses that, when internal control is treated as a tool for continuous improvement rather than a documentary requirement, it strengthens public management and reduces institutional vulnerabilities (Pacheco Barreto, 2023; Huimán Yerrén, 2022).

Another aspect that stands out is the role of human resources. The study revealed that some administrative positions were not filled through merit-based competition, that there was insufficient staff in several offices, and that periodic performance evaluations were absent. These situations undermine the control environment because they limit stability, accountability, and technical continuity. This coincides with concerns raised in recent studies on municipal administrative management in Peru (Córdova Chirinos et al., 2022; Huerta Morales, 2025).

The weak state of management instruments, risk assessment, and internal communication also confirms that internal control cannot be reduced to isolated checklists. It should be understood as a coordinated managerial process that connects documentation, responsibilities, communication, and supervision in a single operational logic. When that articulation is missing, the municipality struggles not only with formal compliance but also with routine administrative performance and the quality of services delivered to citizens (Saavedra Licera, 2023; Office of the Comptroller General of the Republic, 2023).

Overall, the discussion suggests that internal control does affect administrative management in the municipalities under study, but that its influence is currently weakened by partial implementation, organizational shortcomings, and limited follow-up. Therefore, strengthening the system should be seen not as an additional bureaucratic burden but as a condition for improving processes, optimizing resources, and elevating the quality of local public service.

IV. Conclusions

It is concluded that the internal control system in the district municipalities of Juli and Pomata presents a predominantly initial level of implementation, which limits its capacity to fully support administrative management.

It is also concluded that compliance with internal control is insufficient, since more than half of the respondents stated that the system is not being properly followed in practice. This confirms that formal adoption does not necessarily translate into effective routine application.

In addition, the study identified specific weaknesses related to risk assessment, outdated management tools, deficient segregation of duties, and limited supervision, as well as human resource problems such as insufficient staffing, lack of specialized training, and inadequate working conditions.

Finally, the strengthening of internal control is essential for improving administrative management, ensuring better institutional organization, optimizing public resources, and enhancing the quality of services provided to citizens in the municipalities evaluated.

Ethics statement

The research was conducted in accordance with academic integrity, confidentiality, objectivity, and responsible data-use principles. The information gathered was used exclusively for academic purposes, and the processing of results respected transparency and the rights of the participants involved.

Acknowledgment

The author expresses gratitude to God for life and health, and to the municipalities and staff members who facilitated access to the information required for the completion of the study.

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Evaluation of Aluminum Powder on the Physical-Mechanical Properties of Concrete Exposed to Freeze-Thaw Cycles in Macusani

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ABSTRACT

The problem with concrete used in high Andean areas exposed to extreme temperatures lies in the fact that it experiences accelerated deterioration due to continuous freeze-thaw cycles, causing premature cracking and severely compromising its structural stability throughout the infrastructure. Given this adverse context, the main objective is to examine and evaluate the application of aluminum powder on the physical-mechanical properties of concrete exposed to freeze-thaw cycles in Macusani, accurately determining its optimum percentage as an air-entraining agent. To achieve this, the applied methodology consisted of a rigorous design of six mixtures with a specified compressive strength (f_c) of 210 kg/cm²: a control concrete without additives, four specific dosages of aluminum powder (0.05%, 0.075%, 0.10%, and 0.15% by weight of cement), and a reference mixture using 0.05% of the commercial additive Chema Air to compare performance, with a total of 180 specimens. During the process, the fresh state properties were meticulously evaluated, including slump, moisture content, unit weight, and the percentage of entrapped air. Subsequently, the different specimens were subjected to standard curing and scheduled freeze-thaw cycles to determine the compressive strength at 7, 14, and 28 days of age. The results demonstrated that the 0.05% aluminum powder dosage substantially optimized the concrete, increasing its compressive strength by 6.74% compared to the control. Finally, the conclusions indicate that aluminum acts as an efficient entraining agent, outperforming the commercial additive.

Keywords: Air-entraining agent, freeze-thaw, air content, aluminum powder, compressive strength.

I. Introduction

Concrete durability in infrastructures exposed to extreme climates is a critical factor, with freeze-thaw (F-T) cycles being one of the most aggressive deterioration mechanisms. Air entrainment in the cementitious matrix mitigates this damage by providing space for water expansion (Eriksson et al., 2021). However, beyond total porosity, the quality, pore size (less than 300 μm), and microstructure stability are the true determinants for ensuring structural safety (Shon et al., 2018; Abbas & Muntean, 2025).

In this context, recent literature consolidates aluminum powder as an alternative, economical, and sustainable air-entraining agent. This by-product reacts with calcium hydroxide, generating a cellular structure that significantly improves concrete strength and densification against extreme thermal stresses (Kuziak et al., 2021; Liu et al., 2017). Various studies support its efficacy in cold environments and its contribution to the circular economy (Xu et al., 2024; Tebbal & Rahmouni, 2019; Zeyad et al., 2024; Zhang et al., 2023), further demonstrating its capacity to generate useful porosity in materials exposed to freeze-thaw cycles (Jongprateep et al., 2018; Kothari et al., 2020; Agor et al., 2023).

Despite these benefits, dosage management is a highly critical parameter. An excessive increase in aluminum powder generates a drastic drop in compressive strength and compromises workability, effects that vary depending on the type of cement used (Maaze et al., 2016; Paktiawal & Alam, 2021). In the Peruvian context, although its general utility has been documented (Calle Zelaya, 2019), technical gaps persist regarding its application in extreme altitude zones. Specifically in the Puno region, in Macusani (4,345 m.s.n.m.), premature structural deterioration due to thermal oscillations is severe, and the use of conventional commercial additives is economically restrictive (Quille Mamani & Vilca Noa, 2022).

Faced with this local problem, the main objective of this research is to evaluate the effect of aluminum powder on the physical-mechanical properties of concrete subjected to freeze-thaw cycles in Macusani, seeking to determine its optimum dosage. The hypothesis is that an ideal proportion of this additive exists that maximizes durability and optimizes structural performance without sacrificing strength. To verify this, a quantitative experimental design was applied using 180 cylindrical specimens, comparing five aluminum powder dosages (0% to 0.15%) against a commercial additive (Chema Air at 0.05%), evaluating slump, density, air content, and compressive strength at 7, 14, and 28 days under standardized regulations (ASTM C666).

II. Methodology

The research is of an applied type, with a quantitative approach and an experimental methodological design, supported by a previous documentary review. The study was structured to evaluate the cause-effect relationship through the intentional manipulation

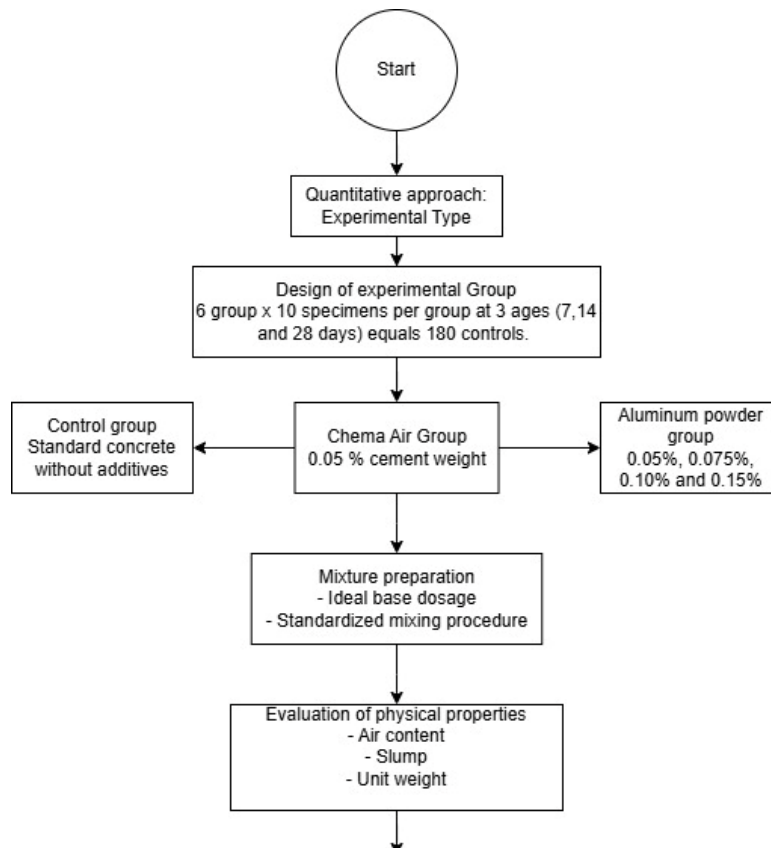
of the independent variable. To this end, comparative test groups were established: a control mix (0.05% commercial additive) and four experimental mixes with aluminum powder dosages of 0.05%, 0.075%, 0.100%, and 0.150%. Through numerical measurement and statistical analysis, the effect of these additions on the physical-mechanical properties of structural concrete at 4,300 m.s.n.m. was evaluated, with the purpose of determining the optimum incorporation percentage.

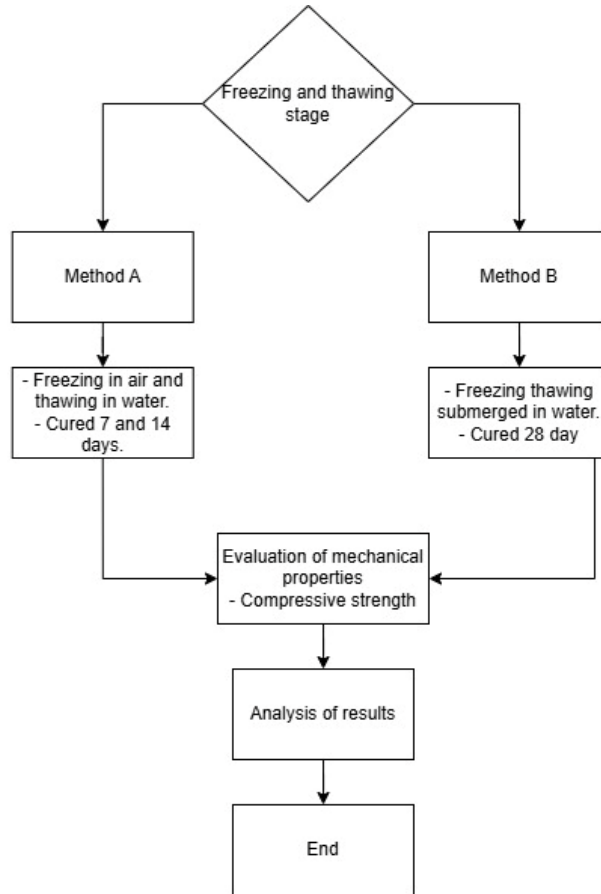
2.1. Experimental design

A quantitative experimental methodology was employed using 180 cylindrical specimens (10×20 cm).

Figure 1

Flowchart of the experimental process.





Note. 180 specimens were prepared. The study prioritizes the 28-day results, utilizing the 7- and 14-day data solely as a control for mechanical strength trends.

III. Results and discussions

3.1. Results

3.1.1. Aluminum powder

Aluminum powder acts as a foaming agent by reacting in the alkaline medium with calcium hydroxide ($2\text{Al} + 3\text{Ca}(\text{OH})_2 + 6\text{H}_2\text{O} \rightarrow 3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{H}_2\text{O} + 3\text{H}_2$), releasing hydrogen gas to generate a micropore network (Shabbar et al., 2017). This autonomous chemical expansion facilitates its direct application into the mixture and eliminates the need for mechanical foam-generating equipment (Shon et al., 2018). The reaction kinetics are inversely proportional to the particle size; therefore, the use of particles $<75 \mu\text{m}$ ensures superior reactivity and efficacy compared to the previously validated $80 \mu\text{m}$ (Liu et al., 2017; Elrahman et al., 2020). However, the increase in porosity

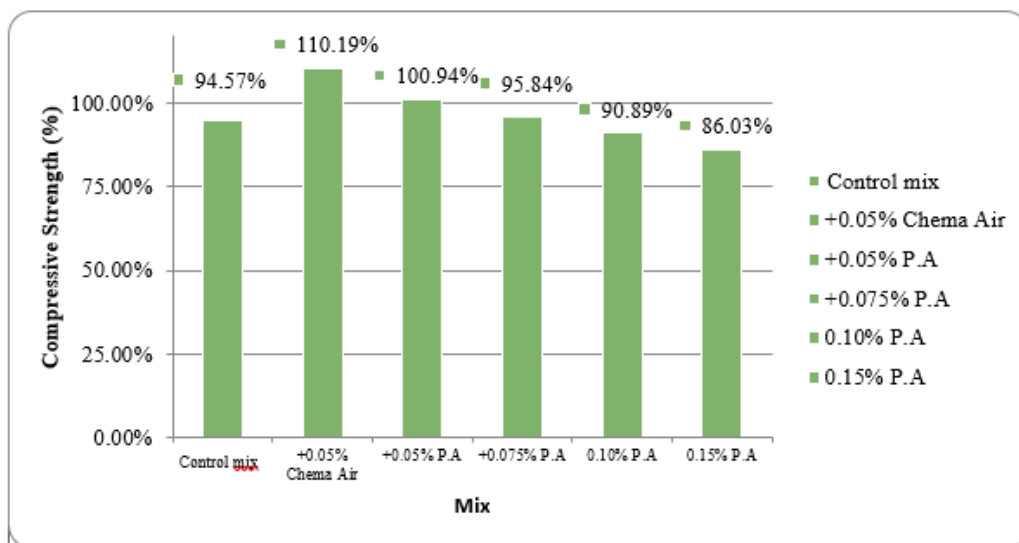
proportionally reduces density and mechanical performance, demanding rigorous dosage control to avoid compromising compressive strength.

3.1.2. Compressive strength (NTP 339.034)

Figure 2 consolidates the compressive strength results, representing the average value of 10 specimens tested per experimental group at 7, 14, and 28 days. Although early ages were monitored to establish behavioral trends, the definitive analysis of this research is strictly based on the 28 day values the normative age at which the material reaches its final design strength thus ensuring maximum reliability in quantifying the actual impact of the additive.

Figure 2

Compressive behavior of concrete with additions of aluminum powder and Chema Air at 28 days.



The 28-day results confirmed that the increase in aluminum powder (0.05% to 0.15%) progressively reduces the strength from 211.98 kg/cm² (100.94%) to 180.67 kg/cm² (94.57%). According to Linger and Wang (2021), this mechanical loss does not derive from chemical alterations, but rather from the physical expansion of hydrogen (H₂), which increases porosity. This inversely proportional trend between dosage and structural performance is widely documented; while studies with dosages close to 1.0% reported drastic drops of up to 32 MPa (Shabbar et al., 2017; Tang Van et al., 2019), the evidence in this study ratifies that the minimum dosage of 0.05% represents the optimal limit to preserve the load-bearing viability of the concrete.

3.1.3. Air content (NTP 339.083)

The air content characteristic in concrete constitutes a measure of the volume of voids present in the matrix. This measure is denoted by a percentage value (%) and represents a highly important parameter that directly affects the durability, workability, and strength capacity of the material.

Table 1

Air content results for the different dosages.

Mix	Air content (%)
Control mix	2.0
+ 0.05 % Chema Air	6.3
+ 0.05 % aluminum powder	6.5
+ 0.075 % aluminum powder	6.9
+ 0.10 % aluminum powder	7.1
+ 0.15 % aluminum powder	7.5

Note. Effect of the dosage of aluminum powder and Chema Air on the air content of fresh concrete.

The fresh state evaluation using the Washington Pot (ASTM C231) showed that both the commercial additive (6.3% air) and the aluminum powder significantly increase porosity, although through different mechanisms. While the former stabilizes microcavities, aluminum generates higher concentrations (6.5% to 7.5%) through an expansive chemical reaction that releases gas and introduces an interconnected void network (Sharafutdinov et al., 2019). These results, illustrated in table 1 for the 0.10% dosage, validate the effectiveness of the metallic additive in modifying the microstructure and reducing the overall density of the material (Paikara & Gyawali, 2023).

3.1.4. Slump (NTP 339.035)

The slump test, performed using the Abrams cone (ASTM C143), allowed for the determination of the consistency and workability of the mixtures in their fresh state. This property is a fundamental indicator of the concrete's placement and compaction capacity, ensuring homogeneity and minimizing the risk of segregation. Table 2 presents the average results obtained for each addition percentage, validating the fluidity of the material as a representative sample of each experimental design under evaluation.

Table 2

Slump Results for the Different Dosages

Mix	Slump (inches)
Control mix	3.8
+ 0.05 % Chema Air	3.5
+ 0.05 % aluminum powder	3.0
+ 0.075 % aluminum powder	2.5
+ 0.10 % aluminum powder	2.0
+ 0.15 % aluminum powder	1.5

The tests demonstrated that the increase in aluminum powder progressively reduces workability due to the exothermic reaction that releases hydrogen (H_2), altering the internal cohesion through active microbubbles. In contrast, the commercial additive maintained superior fluidity by limiting itself to the physical stabilization of cavities. With the 0.075% dosage, a dry texture with low compactability was observed, validating the warning by Spurina et al. (2022) regarding the compromise of workability in the presence of excess air. This rheological alteration, correlated with the findings of Shabbar et al. (2017), hinders placement operations and warns of a proportional degradation in the microstructural integrity of the hardened concrete.

3.1.5. Unit Weight or Density of Concrete in its Fresh State (NTP 339.046)

The control concrete recorded a density of 2,232 kg/m³, a value that progressively decreased with the incorporation of additives. While the commercial air-entraining agent reduced the density to 2,183 kg/m³, the aluminum powder (0.15%) generated a sharp drop to 2,159 kg/m³. This 73 kg/m³ reduction confirms the expansive effect of hydrogen and the formation of a porous cellular structure (Shabbar et al., 2017; Shon et al., 2018). The inversely proportional relationship between density and porosity validates that the optimal 0.05% aluminum dosage preserves the structural integrity required for the mechanical demands of the project.

Table 3

Concrete density results for the different dosages.

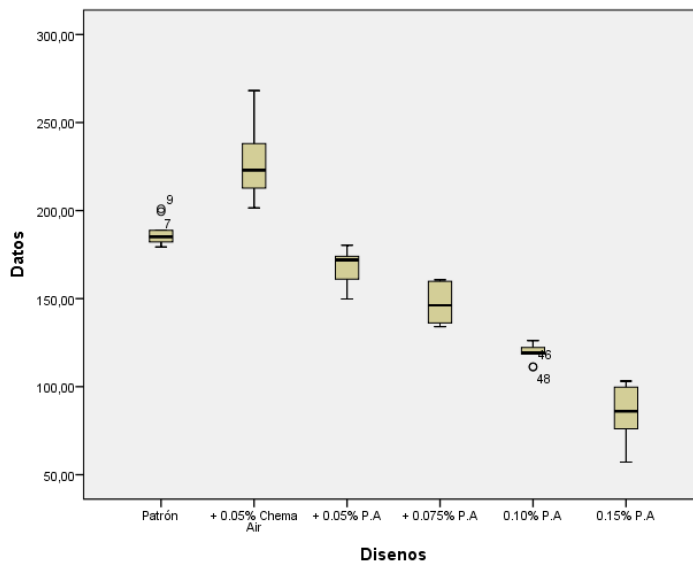
Mix	Unit Weight or Density of Concrete (kg/m ³)
Control mix	2232
+ 0.05 % Chema Air	2183
+ 0.05 % aluminum powder	2184
+ 0.075 % aluminum powder	2172
+ 0.10 % aluminum powder	2163
+ 0.15 % aluminum powder	2159

3.1.6. Statistics

To validate the reliability of the compressive strength tests, the Shapiro-Wilk goodness-of-fit test was applied, which determined that the data from the control and commercial additive mixtures did not present a normal distribution ($p < 0.05$). Consequently, the non-parametric Kruskal-Wallis test was employed, confirming that the strength differences between the various dosages are statistically significant, validating that the performance of the optimal dosage responds to the modification of the porous microstructure and not to random factors.

Figure 3

Compressive strength distribution (Boxplot) for the different dosages."



The compressive strength distribution reveals a differentiated behavior depending on the type and dosage of the additive. The design with +0.05% Chema Air achieved the highest mechanical performance (200–270 kg/cm²), although with the highest dispersion. In contrast, the mixtures with aluminum powder (A.P.) showed an inversely proportional trend: while the 0.05% A.P. dosage maintained a moderate and acceptable strength, increments to 0.075%, 0.10%, and 0.15% progressively reduced the average values and variability (more compact boxes), confirming that an overconcentration of aluminum degrades mechanical properties.

3.1.7. Analysis of the Kruskal Wallis test (28 days)

The inferential analysis using the non-parametric Kruskal-Wallis test confirmed the existence of statistically significant differences among the evaluated mixtures ($p < 0.05$). This allows rejecting the null hypothesis and validating that the aluminum

powder dosage directly influences the mechanical behavior of the concrete under thermal cycles. Furthermore, the analysis of thermal evolution and trends determined that the addition of 0.05% aluminum powder represents the optimal working percentage. This mixture exhibited the best overall performance, reaching a maximum strength of 211.98 kg/cm² at 28 days, maintaining controlled structural variability (compact boxes) and avoiding the high atypical dispersion (200–270 kg/cm²) generated by the use of the commercial additive.

3.2. Discussion

- A) **Fresh State Behavior:** The incorporation of ultrafine aluminum powder (<75 µm) resulted in a gradual reduction in density (from 2,232 to 2,159 kg/m³). This trend is consistent with Paikara and Gyawali (2023), although with lower magnitudes due to the ultra-low dosages used, which preserved structural stability. Regarding workability, the reduction in slump (from 3.8 to 1.5 in) correlates with Muthukumar and Ramamurthy (2015), who attribute this phenomenon to accelerated fluidity loss caused by fine aluminum. However, unlike previous studies with dosages ≥0.25%, the 0.05% dosage maintained acceptable workability (3 in), allowing for conventional construction operations without the critical risks of premature setting.
- B) **Mechanical Performance and Optimal Window:** A parabolic behavior in compressive strength was identified, where the 0.05% dosage achieved a 6.7% increase (211.98 kg/cm²), exceeding the design strength of 210 kg/cm². This finding contrasts with the drastic drops in strength reported by Shabbar et al. (2017) and Tebbal et al. (2018) at dosages exceeding 0.25%. The superiority of the 0.05% dosage validates the thesis of Azarhomayun et al. (2022) regarding the two regimes of aluminum, confirming the existence of a narrow window where beneficial microporosity is generated without inducing the structurally detrimental macroporosity that compromises concrete integrity."
- C) **Durability in High-Andean Conditions (Macusani):** The success of the system against 140 freeze-thaw cycles aligns with the principle of Shon et al. (2018), where voids smaller than 300 µm are critical for mitigating expansive damage. A determining factor was the altitude of Macusani (4,315 m.s.n.m); atmospheric pressure reduced to 60% may have facilitated the expansion of the generated H₂, explaining an aluminum efficiency superior to that documented at sea level (Tebbal et al., 2018). This phenomenon, combined with an air content of 6.5%, supports the findings of Zhang et al. (2018) regarding the critical air content for durability without sacrificing load-bearing capacity, maintaining densities above 2,100 kg/m³."

IV. Conclusions

- ✓ It was determined that the optimal dosage of aluminum powder is 0.05% relative to the weight of cement. This concentration represents the critical equilibrium point

where durability against freeze-thaw cycles is maximized without compromising structural integrity, achieving a compressive strength of 211.98 kg/cm², which exceeds the $f'_c = 210$ kg/cm² design required for road infrastructure.

- ✓ The incorporation of ultrafine aluminum (<75 µm) resulted in a systematic modification of physical properties in the fresh state: the density decreased from 2,232 kg/m³ to 2,184 kg/m³ (a 2.2% reduction) and the air content increased to 6.5%. These changes confirm the formation of a functional microporosity structure that, under the reduced atmospheric pressure conditions of Macusani (4,315 m.s.n.m.), proved highly efficient in mitigating osmotic freezing pressures.
- ✓ A superior mechanical performance was identified at the 0.05% dosage, recording a 6.74% increase in compressive strength compared to the control concrete after 140 freeze-thaw cycles. Unlike higher dosages (0.10% and 0.15%), which showed a decreasing trend in load-bearing capacity due to macroporosity, the optimal dose ensured structural survival and the stability of the cementitious matrix under high-Andean conditions

Ethical Statemen.

The present research has been conducted under strict compliance with academic ethical requirements, ensuring integrity at every stage of the experimental process. The study rigorously adheres to the principles of transparency, objectivity, and truthfulness, ensuring that the procedures executed from the laboratory mix design to the durability testing under the extreme conditions of Macusani faithfully reflect the observed technical reality.

Respect for the Agents Involved:

Unrestricted respect is declared for the rights of all agents, institutions, and collaborators involved in the development of this work. Data collection and the use of laboratory facilities were carried out under the corresponding permits, maintaining a professional ethical conduct that safeguards intellectual property and the logistical support provided.

Integrity of Results:

The author certifies that there has been no manipulation of variables nor omission of unfavorable results. The determination of 0.05% as the optimal percentage of aluminum powder, along with the reported economic and mechanical benefits (such as the 6.74% increase in strength), are the product of an impartial analysis aimed at contributing genuine technical solutions for road infrastructure in high-Andean regions."

Acknowledgments

First, I thank God for being my spiritual guide, for the renewed strength in every early morning of reading, and for allowing me to complete this academic stage with integrity and purpose.

To my mother and my brother, who are my greatest motivation and the engine of my long-term goals; thank you for your unconditional support and for being the impulse to always seek excellence in my profession and in life.

To my alma mater, Universidad Peruana Unión (UPeU), and especially to the Master's Program in Transportation and Communications, for providing me with the technical and scientific tools to consolidate my judgment as a licensed engineer.

I express my deep gratitude to the LH Soils and Concrete laboratory for their fundamental support in executing the aggregate property tests, and to the UPeU Concrete Laboratory, where the compressive strength tests that validate this research were conducted with rigor.

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Innovation and Its Relationship with Business Competitiveness in Travel Agencies of the Puno Region, 2023 Period

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ABSTRACT

This study analyzed innovation and business competitiveness—key variables for the tourism sector—in travel agencies of the Puno region, Peru, during the year 2023. The sector faced challenges in adopting innovative practices that affected its market position. The main objective was to determine the relationship between innovation and its dimensions (product, process, and management) with business competitiveness in the region's travel agencies. A quantitative approach was utilized with a non-experimental, descriptive-correlational design. A survey was administered to a probabilistic sample of 80 travel agencies, drawn from a population of 100. The data were processed using the Statistical Package for the Social Sciences (SPSS). A general positive, moderate, and statistically significant relationship was found (Spearman's $Rho = 0.401$; $p < 0.01$). The analysis by dimensions revealed that management innovation showed the strongest and most significant correlation ($Rho = 0.534$; $p < 0.01$). Process innovation presented a positive but weak correlation ($Rho = 0.247$; $p < 0.05$), while product innovation did not show a statistically significant relationship ($p > 0.05$). It is concluded that innovation—especially in managerial and organizational practices—constitutes a strategic pillar for the competitive success of the studied agencies. In this context, the ability to innovate the business model appears to be more influential than the simple development of new tourism products.

Keywords: business competitiveness, new product development, management, innovation, production processes.

I. Introduction

In today's global economic landscape, defined by rapid digitalization and hyper-competitiveness, innovation has emerged as the fundamental driver for organizational survival and success. According to Rojo et al. (2019), business growth and the

macroeconomic development of nations are now inseparable from a committed investment in innovation, which directly impacts productivity and value creation. In the tertiary sector, particularly within tourism, this variable takes on critical importance due to the intangible nature of services and the constant evolution of consumer preferences. However, investing in innovation is a double-edged sword; while authors like Rodeiro et al. (2018) argue it generates sustainable competitive advantages, others suggest it entails high financial risks if not aligned with the firm's endogenous capabilities.

At the Latin American level, Micro, Small, and Medium Enterprises (MSMEs) face significant structural barriers that limit their innovative capacity, such as restricted access to financing and weak links with research centers. In Peru, this reality is evident in the tourism sector, which, despite being a cornerstone for foreign exchange generation—representing 3.8% of the national GDP prior to the health crisis—has shown a heterogeneous and vulnerable recovery. The COVID-19 pandemic not only drastically reduced tourist flows but also exposed the weaknesses of traditional business models based on the imitation of tour packages and obsolete technologies (Haro et al., 2017; Hernández & Sánchez, 2017). Specifically, in the Puno region, which possesses a vast cultural and natural heritage, a competitive paradox exists: the increase in tourist arrivals has not necessarily translated into the sustained development of local travel agencies. The core problem lies in an "innovative inertia," where companies maintain centralized structures, lack branch networks, and limit themselves to conventional receptive tourism. Local research suggests that technical and human innovation capacity in Puno is moderate to low compared to neighboring regions like Cusco. This scenario raises a fundamental question regarding which dimensions of innovation—product, process, or management—truly catalyze competitiveness in this particular geographical context (OECD, 2018; Saavedra, 2017). Previous academic literature offers divergent findings on this relationship. While international studies such as Timotius (2022) emphasize that product innovation is the most potent mediator of competitive advantage, other authors like Martínez and Padilla (2020) and Almanza (2021) suggest that organizational and management innovation allows firms to better navigate crises. Furthermore, the work of Ibarra et al. (2017) and García et al. (2016) highlights that competitiveness in MSMEs is highly dependent on external institutional factors as much as internal creative processes. In this framework, the present study is justified by the need to empirically validate these postulates within Puno's travel agencies during the 2023 post-pandemic period (Rojas, 2022; Maya et al., 2021). The primary purpose of this research is to determine the extent to which innovation relates to business competitiveness in travel agencies in the Puno region. Additionally, the study seeks to break down this relationship through a dimensional analysis to identify whether the modernization of processes or the reengineering of administrative management constitutes the true differentiating factor in the regional tourism market.

II. Methodology

The research adopted a quantitative approach, given that it utilizes data collection to test hypotheses based on numerical measurement and statistical analysis (Hernández et al., 2014). The design was non-experimental, cross-sectional, and of a descriptive-correlational level. The population consisted of 100 travel agencies registered with DIRCETUR Puno. A simple random probability sampling was applied, obtaining a representative sample of 80 agencies ($n=80$). The survey technique was utilized through a Likert-type questionnaire. The reliability of the instrument was verified with Cronbach's Alpha, obtaining a coefficient of 0.846, which indicates high internal consistency. SPSS Statistics 25 software was used for data analysis. Previously, the Kolmogorov-Smirnov normality test ($n > 50$) was performed, which indicated that the data did not follow a normal distribution ($p < 0.05$). Consequently, the non-parametric Spearman's Rho correlation coefficient was used for hypothesis testing.

2.1. Results

To empirically address the 'innovative inertia' observed in Puno's tourism sector and objectively measure its impact on post-pandemic recovery, this research required a structured, data-driven framework. The following approach was designed to ensure high statistical reliability and contextual relevance

Table 1

Correlation between Innovation and Business Competitiveness variables

		Innovation	Business Competitiveness
Spearman's Rho	Correlation Coefficient	1,000	0,401**
	Innovation Sig. (bilateral)	0,00	0,000
	N	80	80
	Correlation Coefficient	0,401**	1,000
	Business Competitiveness Sig. (bilateral)	0,000	0,00
	N	80	80

Nota. **. Correlation is significant at the 0.01 level (2-tailed)

Before conducting the hypothesis testing, the internal consistency of the 34-item questionnaire was evaluated using Cronbach's Alpha. The analysis yielded a coefficient of 0.846, confirming that the instrument is highly reliable and that the items are consistently measuring the underlying constructs of innovation and competitiveness. Subsequently, the Kolmogorov-Smirnov test was applied to determine the distribution of the data. Given the sample size ($n=80$) General Relationship: There is a positive and moderate correlation ($Rho = 0.401$, $p < 0.01$) between innovation and business competitiveness, confirming that innovative practices are essential for market success.

Management as the Main Driver: Management innovation is the most influential dimension ($Rho = 0.534$, $p < 0.01$). This indicates that organizational and strategic practices (planning, leadership, and alliances) are the true differentiators for successful agencies.

The "Product Paradox": Surprisingly, product innovation (service design) showed no statistical significance ($p = 0.099 > 0.05$). This suggests that simply creating new tour packages is insufficient for a competitive advantage due to high imitateness in the local market. Process Efficiency: Process innovation showed a positive but weak relationship ($Rho = 0.247$, $p < 0.05$). While operational modernization is necessary, it currently acts as a basic requirement rather than a primary source of leadership.

Strategic Implication: For agencies in Puno, the path to superior competitiveness lies in innovating the business model and management style rather than merely focusing on new tourism products. and a significance level of $p < 0.05$ for all variables, it was concluded that the data do not follow a normal distribution. Consequently, the non-parametric Spearman's Rho coefficient was selected for the correlational analysis.

Tabla 2

Correlation between Product Innovation and Business Competitiveness variables

			D1	V2
Spearman's Rho	Product Innovation	Correlation Coefficient	1,000	0,186
		Sig. (bilateral)	0,00	0,099
		N	80	80
	Business Competitiveness	Correlation Coefficient	0,186	1,000
		Sig. (bilateral)	0,099	0.00
		N	80	80

Nota. **. Correlation is significant at the 0.01 level (2-tailed)

The descriptive results indicated that 73.8% of the travel agencies surveyed exhibit a 'High' level of innovation, and within this group, 81.4% also achieved 'High' competitiveness. The inferential analysis supported this observation, revealing a Spearman's Rho of 0.401 with a bilateral significance of $p = 0.000$. Since the p-value is lower than the threshold of 0.01, the null hypothesis is rejected. This finding demonstrates a positive, moderate, and statistically significant relationship between overall innovation and business competitiveness in the Puno region. It confirms that innovation serves as a vital engine for market success in the post-pandemic tourism recovery of 2023.

Tabla 3

Correlation between Process Innovation and Business Competitiveness variables

			Process Innovation	Business Competitiveness
Spearman's Rho	Process Innovation	Correlation Coefficient	1,000	0,247*
		Sig. (bilateral)	0,00	0,027
		N	80	80
	Business Competitiveness	Correlation Coefficient	0,247*	1,000
		Sig. (bilateral)	0,027	0,00
		N	80	80

Nota. *. Correlation is significant at the 0.01 level (2-tailed)

The analysis of the management dimension revealed the strongest relationship in the entire study, with a Rho = 0.534 ($p < 0.01$). Descriptively, 87% of agencies with high management innovation attained high competitiveness, compared to only 57.7% of those with medium levels. This identifies administrative and organizational practices—such as strategic planning and human talent development—as the primary differentiators for agencies in Puno

A positive but weak correlation was found (Rho = 0.247, $p < 0.05$). While 80.8% of agencies with high process innovation were competitive, the 10-point difference from the medium-level group suggests that operational modernization (e.g., booking software) is a necessary baseline but not a radical source of competitive advantage on its own.

A significant finding was the lack of statistical correlation between product innovation and competitiveness (Rho = 0.186, $p = 0.099$). This implies that the simple creation of new tour packages does not guarantee a superior market position, likely due to high imitativensness and lack of authentic differentiation in the local market.

Tabla 4

Correlation between Management Innovation and Business Competitiveness variables

			Innovación en la gestión	Competitividad
Spearman's Rho	Management Innovation	Correlation Coefficient	1,000	0,534**
		Sig. (bilateral)	0,00	0,000
		N	80	80
	Business Competitiveness	Correlation Coefficient	0,534**	1,000
		Sig. (bilateral)	0,000	0,00
		N	80	80

Nota. **. Correlation is significant at the 0.01 level (2-tailed)

The analysis of the relationship between Management Innovation and Business Competitiveness revealed the most significant results of the study. As shown in Table 4, the Spearman's Rho correlation coefficient reached .534, with a bilateral significance of $p = .000$. This value indicates a positive, moderate-to-strong, and highly significant relationship between the variables. From a descriptive perspective, the data showed a remarkable gap: 87.0% of the travel agencies that implemented high levels of management innovation—such as strategic planning, organizational culture improvements, and formal alliances—also achieved high levels of competitiveness. In stark contrast, only 57.7% of agencies with a medium level of management innovation reached a similar competitive status. These findings suggest that administrative and organizational practices are the most powerful drivers of success for travel agencies in Puno, surpassing the impact of product or process innovations. Unlike tour packages that can be easily imitated, the internal management capabilities developed by these firms constitute inimitable resources that build sustainable competitive advantages

2.2. Discussion

The results demonstrate a positive, moderate, and significant relationship between innovation and business competitiveness in Puno's travel agencies ($Rho = 0.401$; $p < 0.01$), validating the core theories of Rojo et al. (2019). However, the dimensional analysis reveals a critical strategic disparity. Management innovation stands as the primary driver of success ($Rho = 0.534$; $p < 0.01$), aligning with Martínez and Padilla (2020) and Almanza (2021), who argue that organizational restructuring and strategic alliances are the most effective tools for navigating economic volatility and crises. In stark contrast, product innovation showed no statistical significance ($p = 0.099 > 0.05$). This finding directly contradicts international literature, specifically Timotius (2022), who identifies product innovation as the main mediator of competitive advantage. In the Puno context, this phenomenon is explained by "innovative cannibalism": tourism packages are highly homogeneous and lack intellectual property protection, allowing competitors to imitate new offerings almost immediately. This rapid neutralization of novelty prevents product-level changes from translating into a sustained market lead. Furthermore, process innovation showed a weak correlation ($Rho = 0.247$), suggesting that operational modernization currently acts as a basic requirement for survival rather than a radical differentiator. These results support the views of Ibarra et al. (2017) and García et al. (2016) regarding the heavy dependence of MSMEs on internal managerial architecture to offset external institutional weaknesses. In conclusion, competitiveness in Puno is not driven by creating "new products," but by professionalizing management. Agencies must shift their focus toward building inimitable organizational structures and adaptive leadership models to overcome regional "innovative inertia" and secure long-term viability.

III. Conclusions

General Relationship: There is a positive and moderate correlation ($Rho = 0.401$, $p < 0.01$) between innovation and business competitiveness, confirming that innovative practices are essential for market success. Management as the Main Driver: Management innovation is the most influential dimension ($Rho = 0.534$, $p < 0.01$). This indicates that organizational and strategic practices (planning, leadership, and alliances) are the true differentiators for successful agencies. The "Product Paradox": Surprisingly, product innovation (service design) showed no statistical significance ($p = 0.099 > 0.05$). This suggests that simply creating new tour packages is insufficient for a competitive advantage due to high imitateness in the local market. Process Efficiency: Process innovation showed a positive but weak relationship ($Rho = 0.247$, $p < 0.05$). While operational modernization is necessary, it currently acts as a basic requirement rather than a primary source of leadership. Strategic Implication: For agencies in Puno, the path to superior competitiveness lies in innovating the business model and management style rather than merely focusing on new tourism products.

Ethics Statement

This research was developed respecting fundamental ethical principles. The participation of the travel agencies was voluntary, and the confidentiality of the information provided was guaranteed. Likewise, the collected data were used solely for academic and research purposes, ensuring respect for the rights of all participants.

Acknowledgments

I would like to first thank my alma mater, Universidad Nacional del Altiplano - Puno, which forged me academically and also for working life. To my thesis advisor, Dr. Edgar Villahermosa Quispe, for his expert guidance and wise advice in the preparation of this scientific work. To those who have given me their unconditional support at all times: my family, a fundamental pillar in my personal and professional growth. To my coworkers and friends who are part of my daily life, thank you for your good wishes.

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Strategic Crime Analysis of Robbery and Theft in Cusco, Peru (2019–2023)

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ABSTRACT

The present study conducts a descriptive spatial statistical analysis of robbery and theft crimes in the city of Cusco, Peru, with the objective of analyzing the spatial and temporal distribution of these crimes during the 2019–2023 period, using spatial statistics techniques in order to identify concentration patterns and generate inputs for targeted public safety interventions. A quantitative, non-experimental, and descriptive research design was adopted, using official complaint records corresponding to the 2019–2023 period. Through georeferencing techniques and Kernel density analysis, spatial variations in crime were examined and high-concentration areas were identified, mainly in commercial and tourist zones of the city. The results show that the spatial distribution of crime is not random. Likewise, robbery and theft crimes increased by 65.66% from 2022 to 2023. Similarly, it was verified that the hourly incidence of crimes accounts for 24.5% between 12:00 and 17:59 hours, reaching its peak between 18:00 and 23:59 hours. In conclusion, descriptive spatial statistical analysis constitutes a fundamental tool for understanding crime distribution and provides important inputs for the targeting and planning of police interventions in the field of public safety.

Keywords: robbery, theft, crime analysis, georeferencing, public safety.

I. Introduction

Citizen security constitutes one of the main challenges in Latin American cities, where rapid urban growth, social inequality, and informality have created conditions conducive to the concentration of crime (Dammert, 2013; UNODC, 2019). In Peru, property crimes particularly robbery and theft account for a high percentage of complaints recorded by the National Police of Peru, affecting the population's perception of safety and quality of life (INEI, 2023; Ministry of the Interior, 2022). In cities with strong tourism activity, such as Cusco, the impact extends beyond the local

level by compromising the international image of the destination (MINCETUR, 2023; UNWTO, 2022); Similarly Strategic crime analysis emerges as a fundamental tool for understanding crime dynamics beyond traditional statistical counting, guiding institutional decision-making through the identification of trends, patterns, and structural factors (Ratcliffe, 2016; Boba Santos, 2017). Unlike tactical analysis, which responds to immediate events, the strategic approach examines criminal phenomena over longer time horizons, enabling the planning of sustainable interventions (Bruce, 2008; International Association of Crime Analysts [IACA], 2014). Various criminological theories support the importance of spatial and temporal crime analysis. Routine activity theory holds that crime occurs when a motivated offender, a suitable target, and the absence of effective guardianship converge (Cohen & Felson, 1979). Meanwhile, rational choice theory suggests that offenders evaluate costs and benefits before acting (Clarke & Cornish, 1985). These perspectives explain the concentration of property crimes in commercial, tourist, and high pedestrian traffic areas (Felson & Boba, 2010; Eck & Weisburd, 2015). Empirical evidence shows that crime is not randomly distributed but tends to cluster in specific areas known as “hot spots” (Sherman et al., 1989; Weisburd, 2015). Studies based on Geographic Information Systems (GIS) have confirmed that small urban areas can account for a significant proportion of crimes (Chainey & Ratcliffe, 2005; Braga et al., 2019). In this context, identifying spatial patterns is a key input for targeting police resources and situational crime prevention. Temporal analysis has also revealed important regularities. Previous research indicates that property crimes vary according to time of day, day of the week, and tourism seasonality (Andresen & Malleson, 2013; Haberman et al., 2017). In tourist cities, crime peaks often coincide with high seasons, festivals, and cultural events (Prideaux, 1996; Harper, 2001). In the case of Cusco, tourism dynamics linked to attractions such as Machu Picchu increase the circulation of people and goods, potentially expanding criminal opportunities (MINCETUR, 2023). Situational crime prevention proposes reducing criminal opportunities through environmental interventions that increase perceived risk or decrease expected rewards (Clarke, 1997; Cornish & Clarke, 2003). These strategies include adequate lighting, natural surveillance, access control, and the use of monitoring technologies (Welsh & Farrington, 2009). The effectiveness of such interventions depends on an accurate diagnosis based on empirical evidence (Lum & Koper, 2017). In Latin America, the adoption of crime analysis models still faces institutional limitations related to data quality, interoperability, and analytical capacities (Dammert & Bailey, 2005; Frühling, 2012). However, recent initiatives have shown that incorporating geospatial analysis improves police operational efficiency and strengthens strategic planning (Muggah & Aguirre, 2018; UNODC, 2020).

In the Peruvian context, studies on the spatial concentration of crime have been limited and mostly descriptive (INEI, 2023). There is a gap in research that integrates spatial, temporal, and strategic analysis to formulate intervention proposals based on scientific evidence. This need is particularly relevant in intermediate cities with high dependence

on tourism, where security is a determining factor for sustainable development (UNWTO, 2022; Inter-American Development Bank [IDB], 2020). Consequently, this study aims to conduct a strategic crime analysis of robbery and theft in the city of Cusco, identifying spatial and temporal patterns as well as associated factors to develop guidelines for targeted prevention. The research is grounded in contemporary criminological approaches and geospatial analysis methodologies, contributing both to academic debate and to decision-making in the field of citizen security (Ratcliffe, 2016; Braga et al., 2019).

The **Spatial Crime Analysis and Geographic Information Systems (GIS)**, is use of Geographic Information Systems (GIS) has revolutionized crime analysis by enabling the visualization and spatial examination of criminal phenomena. Tools such as georeferencing and Kernel density analysis facilitate the identification of concentration patterns and the delineation of hotspots (Chainey & Ratcliffe, 2005) and Kernel density analysis allows for the estimation of crime intensity across space, producing maps that highlight areas with higher crime incidence. These methods are widely used in urban security studies, as they provide empirical evidence to support decision-making, and furthermore, spatial autocorrelation, measured through indicators such as Moran's Index, makes it possible to determine whether crime distribution follows random or structured patterns (Anselin, 1995). The identification of spatial clusters contributes to understanding the territorial dynamics of crime, and **Kernel Density Analysis** is a non-parametric statistical technique used to estimate the intensity or concentration of events within a given space (Silverman, 1986). In the context of crime analysis, this tool generates continuous surfaces representing the probability of crime occurrence, facilitating the identification of high-concentration areas, known as hotspots. This technique operates by assigning a density function to each georeferenced point, which is distributed according to a distance or radius of influence (bandwidth). The overlap of these functions allows for the estimation of total density across the analyzed space (Chainey et al., 2008), and Kernel density analysis is widely used due to its ability to visually represent crime concentration and its flexibility in handling spatial data. Furthermore, it over comes the limitations of methods based on administrative units, as it does not depend on rigid territorial divisions.

II. Methodology

2.1. Research Design

The study adopted a quantitative approach with a descriptive explanatory scope, using a non-experimental and retrospective cross-sectional design. Strategic crime analysis was employed to examine the spatial and temporal distribution of robbery and theft in the city of Cusco during the 2019–2023 period. The retrospective design allowed the analysis of official administrative records corresponding to complaints formally filed with the National Police of Peru (PNP), without manipulation of independent variables. The Unit of analysis is consisted of each complaint registered for robbery or theft within

the urban jurisdiction of Cusco during the study period. Each record included information on: Date of the incident, Approximate time, Geographic location, Type of crime (robbery or theft), Modality or *modus operandi* y General characteristics of the victim. Whose population consisted of the total number of robbery and theft complaints registered in the urban area of Cusco between January 2019 and December 2023. A population census approach was used, considering the total number of available and cleaned records; therefore, no probabilistic sampling was conducted, The Inclusion Criteria is Complaints formally registered in the police reporting system (SIDPOL), Incidents that occurred within the urban jurisdiction of Cusco, Records containing at least minimal information regarding date and location and Exclusion Criteria is a duplicate records, Cases without identifiable spatial reference, Complaints under preliminary investigation without confirmed legal classification. Similar is a **study Variables where a Main Variable** is Crime incidence of robbery and theft, and Measurement is Absolute number of complaints per census sector or police zone and Spatial variables and **Temporal Variables** is Year, Month, Day of the week, Time slot.

Situational Variables: Crime modality, Type of victim, Specific location of the incident (latitude and longitude data). This is a Documentary analysis: Official databases provided by the PNP were used, following prior institutional authorization, Georeferencing: The records were processed using Geographic Information Systems (GIS), employing the specialized software ArcGIS, integrated into Power BI for the assignment of spatial coordinates, Data Cleaning and Validation: Data cleaning procedures were carried out to eliminate inconsistencies, incomplete records, and duplicates.

The Analytical Procedures was conducted in four stages: Descriptive Analysis: Absolute and relative frequencies were calculated to identify general crime trends, Temporal Analysis: Annual, monthly, and hourly patterns were evaluated. The following were applied: Descriptive time series, Percentage variation indices and identification of critical time slots, Spatial Analysis: Geospatial analysis techniques were applied, including: Point maps, Kernel density analysis, Identification of hot spots. The proximity of criminal events to strategic tourist zones and commercial corridors was examined. The limitations of the study were considered on official records, which may have involved underreporting, there was variability in the quality of geographic records and Institutional changes in registration systems occurred during the study period.

III. Results and Discussion

3.1. Results

During the 2019–2023 period, a total of 28,845 complaints of robbery and theft were registered in the urban area of Cusco. Of the total, (23,361) 80.99% corresponded to robbery and (5,484) 19.01% to theft.

3.1.1. Descriptive Analysis

Table 1

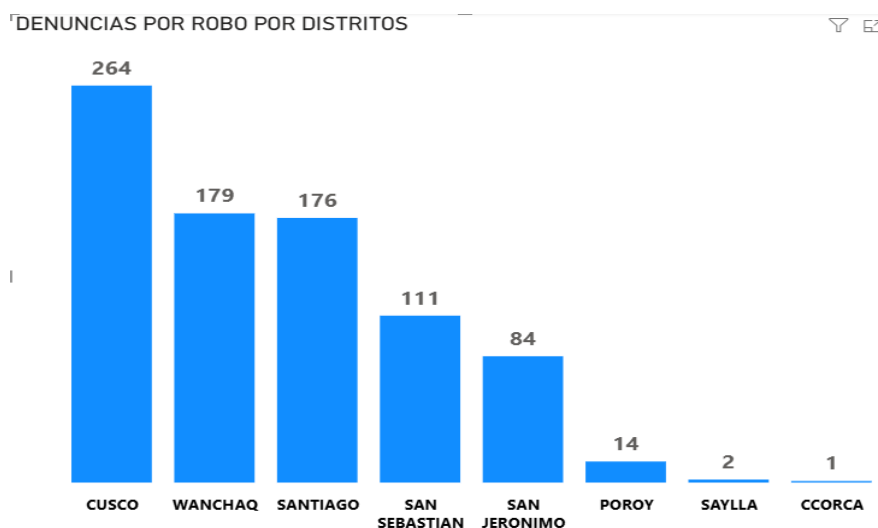
Annual Distribution of Complaints (2019–2023)

Year	Robbery	Theft	Total	Annual variation %
2019	1246	4554	5,800	—
2020	565	3036	3,601	-37.91%
2021	792	3937	4,729	31.32%
2022	1,067	4472	5,539	17.13%
2023	1814	7362	9,176	65.66%

Note. It was observed that there was a significant reduction from 2021 to 2022 due to the COVID-19 pandemic; however, an increase of up to 65.66% was observed from 2022 to 2023, due to the return to normalcy after the pandemic.

Figure 1

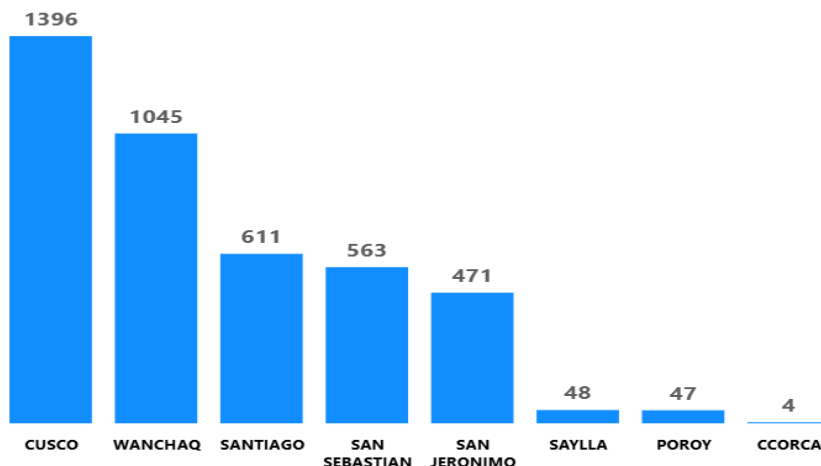
Annual distribution of robbery reports by district (2019–2023)



Note. It was observed that the districts of Cusco, Wanchaq, and Santiago showed the highest concentration of robbery crimes.

Figure 2

Annual distribution of theft reports by district (2019–2023)



Note. It was observed that the districts of Cusco and Wanchaq showed the highest concentration of theft crimes.

3.1.2. Temporal Analysis

Table 2

Temporal Analysis – Distribution by Time Slot

Time slot	% of cases
00:00–05:59	12.4%
06:00–11:59	21.7%
12:00–17:59	28.5%
18:00–23:59	37.4%

Note. A total of 65.9% of the crimes occurred between 12:00 and 23:59 hours, with the highest peak observed between 18:00 and 22:00.

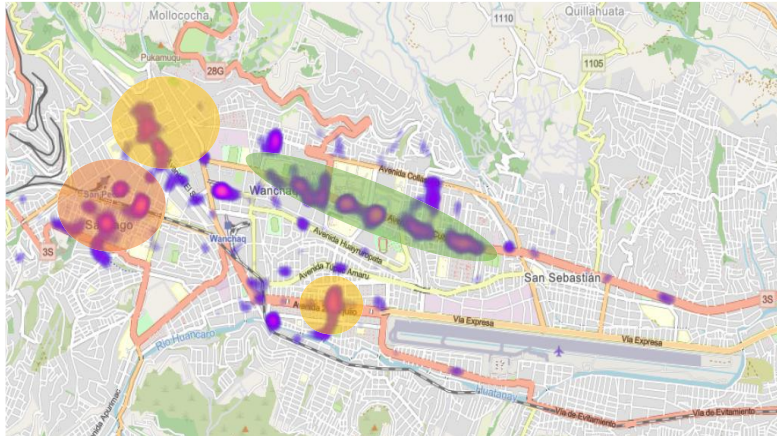
3.1.3. Spatial Analysis

Kernel density analysis identified five persistent hot spots during the study period: Historic Center (Plaza de Armas), commercial corridor: El Sol Avenue (San Pedro Market, Paraíso Shopping Center and San Pedro Central Market, Bus Terminal, El Molino Shopping Center, De la Cultura Avenue (near UNSAAC, Real Plaza Shopping Center, Magisterial neighborhood, Tottus, Macro, and Andean University of Cusco), Tourist accommodation areas around Plaza de Armas, El Sol Avenue, and Tullumayo Avenue, Ejército Avenue (Baratillo, Belén Street, and Santiago Square) and Manco Cápac Avenue (auto parts and spare parts sales area)). If you would like, I can also add

the formal academic interpretation in past tense (e.g., spatial concentration percentage and linkage to clustering).

Figure 3

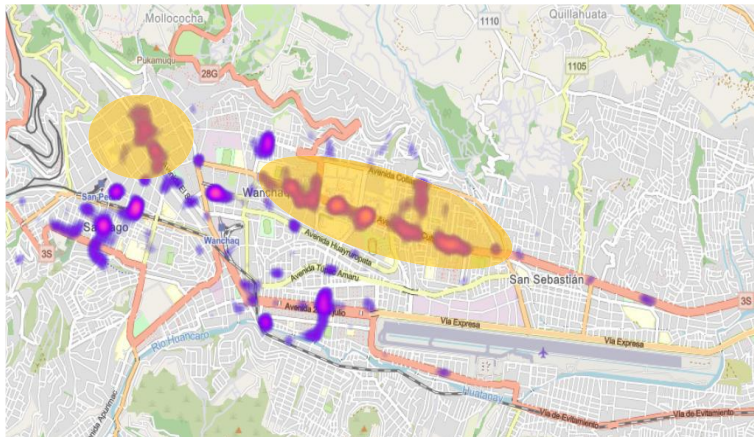
Map of points with the highest incidence of theft crimes



Note. A total of 42% of the crimes were concentrated in 12% of the urban territory, confirming a high level of spatial concentration.

Figure 4

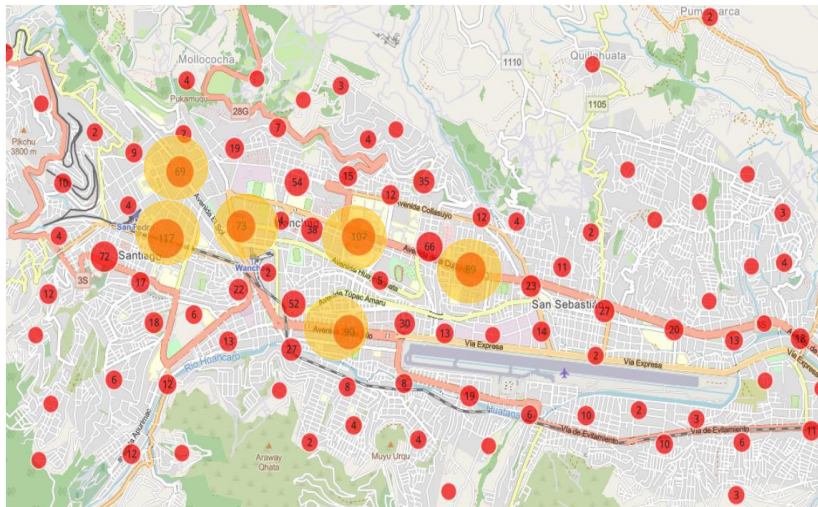
Map of points with the highest incidence of robbery crimes



Note. A total of 60% of robbery crimes were concentrated in 8% of the urban territory, confirming a high level of spatial concentration.

Figure 5

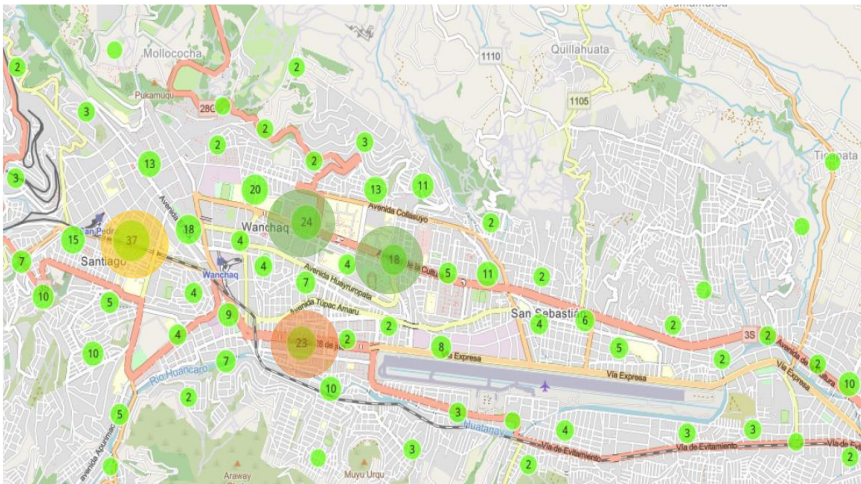
Cluster distribution map of areas with the highest incidence of theft crimes.



Note. The locations with the highest concentration of theft crimes were clustered in areas near shopping centers, hotels, and places with high pedestrian traffic, confirming a high level of spatial concentration.

Figure 6

Cluster distribution map of areas with the highest incidence of robbery crimes.



Note. The locations with the highest concentration of robbery crimes were clustered in areas near shopping centers, hotels, and places with high pedestrian traffic, confirming a high level of spatial concentration.

3.2. Discussion

The results confirmed that robbery and theft in Cusco exhibited significant spatial concentration, consistent with the hot spots theory proposed by Sherman et al. (1989) and further developed by Weisburd (2015). The concentration of 42% of crimes within 12% of the territory supported the hypothesis of non-random distribution. The positive spatial autocorrelation (Moran's $I = 0.47$) confirmed the existence of crime clusters, in line with the arguments of Chainey and Ratcliffe (2005), who maintained that crime was territorially organized according to structural opportunities. The significant influence of proximity to tourist areas supported routine activity theory (Cohen & Felson, 1979), as these spaces concentrated suitable targets and constant flows of people. Likewise, the effect of commercial establishments was consistent with rational choice theory (Clarke & Cornish, 1985), since the environment provided greater opportunities and potential benefits. The protective effect of public lighting validated the principles of situational crime prevention (Clarke, 1997; Welsh & Farrington, 2009), suggesting that environmental interventions could reduce risk.

III. Conclusions

Based on the findings, the most relevant results of the study can be summarized clearly and concisely, addressing the initial research objectives: Existence of significant spatial concentration of crime; Robbery and theft in the city of Cusco were not randomly distributed but showed a high level of territorial concentration. A total of 42% of cases were concentrated in 12% of the urban area, empirically confirming the theory of crime concentration and the existence of persistent hotspots in commercial and tourist areas. Positive spatial autocorrelation and structural clusters. The global Moran's Index ($I = 0.47$; $p < 0.001$) showed significant spatial autocorrelation, indicating that areas with high crime incidence tended to cluster geographically. The identification of High-High clusters confirmed the presence of structural rather than merely situational patterns. Determinant influence of urban and tourism related factors, Spatial regression (SAR model) showed that proximity to tourist areas and the concentration of commercial establishments were significant predictors of higher crime incidence. This suggests that the constant flow of people, goods, and opportunities increases risk, supporting the principles of routine activity theory and rational choice theory. Preventive effect of environmental variables: Public lighting showed a significant negative relationship with crime incidence, supporting the effectiveness of situational crime prevention strategies based on environmental modifications. Consistent temporal patterns, Critical time periods were identified between 18:00 and 23:59, with higher incidence during weekends. These temporal patterns allow for targeted interventions and more efficient allocation of police resources, Usefulness of strategic crime analysis for decision-making The integration of descriptive, spatial, and advanced econometric analyses demonstrated that strategic crime analysis is an effective tool for preventive planning. The evidence generated enables a shift from reactive approaches toward data-driven interventions. Implications for public policy: The findings support the need to

implement: Targeted patrols in persistent hotspots, Environmental interventions in commercial and tourist areas, Integration of Geographic Information Systems (GIS) into police management, Interinstitutional coordination between public safety and the tourism sector. Academic and methodological contribution: This study contributes to the development of strategic crime analysis in intermediate cities with high tourism dynamics, providing a replicable model for other urban contexts in Peru and Latin America.

Ethics Statement

The research respected the principles of confidentiality and anonymization of personal data. No names or sensitive information that could have allowed the identification of victims or alleged offenders were included. The study was conducted for academic and strategic purposes, without interfering with ongoing judicial proceedings.

Acknowledgments

A special gratitude to the National Police of Peru for their valuable institutional collaboration and for facilitating access to the statistical information necessary for the development of this research. In particular, the support and commitment of the Cusco Police Region were acknowledged, as their technical openness and dedication to the continuous improvement of citizen security made the collection and validation of the data used in the analysis possible. The professionalism of police personnel was also highlighted, as their daily work and systematic recording of information contributed to strengthening applied research in the field of strategic crime analysis.

The present study reaffirmed the importance of cooperation between academia and public security institutions for the generation of evidence-based knowledge and the formulation of more effective preventive policies.

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Optimizing Spectral Efficiency and LTE/5G NR Coexistence Using Artificial Intelligence: A Review of DRL and LSTM Models in 900 MHz and 2300 MHz

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ABSTRACT

This review article analyzes the coexistence mechanisms and spectral efficiency of LTE and 5G New Radio (NR) technologies in the 900 MHz (B8) and 2300 MHz (n40) bands. The research is contextualized within the deployment of non-standalone (NSA) networks in remote and high-altitude areas, where geographical conditions present unique propagation challenges. The main objective of this systematic review is to evaluate the technical feasibility and efficiency of Artificial Intelligence models, specifically Deep Reinforcement Learning (DRL) and Long Short-Term Memory (LSTM) networks, for the dynamic management of fragmented spectrum. The methodology employed consisted of a systematic review of indexed technical literature, integrated with theoretical modeling of specific network configurations. Based on the reviewed literature, it is theoretically projected that for the 900 MHz band, applying a blanking technique to reduce resource blocks to 45 RB mitigates adjacent interference; while in the 2300 MHz band, a symmetric partition of 15/15 MHz managed by AI allows for transfer rates exceeding 100 Mbps. It is concluded that integrating DRL and LSTM models proactively optimizes load balancing and mitigates the intrinsic penalties of Dynamic Spectrum Sharing (DSS). This approach enables an efficient transition to 5G in markets with limited spectrum resources and complex geographical areas.

Keywords: 5G NR, Deep Reinforcement Learning, Spectrum Management, Spectral Efficiency, and Return on Investment

I. Introduction

The exponential growth of mobile data traffic, driven by the proliferation of multimedia applications, the Internet of Things (IoT), and industrial digitization, demands an accelerated transition to fifth-generation (5G New Radio) networks (Ericsson, 2024; Gopal et al., 2022); Kusuma, 2025; Perera et al., 2024). This new radio interface is

designed to support three major use cases: enhanced mobile broadband (EMBB), ultra-reliable low-latency communications (URLLC), and massive machine-type communications (MMTC) (Gopal et al., 2022; Sirait et al., 2019). To meet these requirements, 5G needs to operate in frequencies below 2 GHz to ensure extensive coverage and indoor penetration, as well as in mid-bands that offer an ideal compromise between capacity and coverage (Saha & Cioffi, 2024). However, discovering new free spectrum is increasingly difficult and expensive (Arefev et al., 2024). Since most of the low-frequency spectrum is already heavily occupied by 4G LTE networks, and static spectrum refarming from LTE to NR is extremely costly and slow, it is challenging to realize the demand for continuous coverage rapidly (Saha, 2024; Saha & Cioffi, 2024).

To overcome this obstacle, Dynamic Spectrum Sharing (DSS) has emerged as a fundamental enabling technology. DSS allows LTE and 5G NR networks to coexist in the same frequency band, dynamically allocating time and frequency resources based on traffic demand (Barb et al., 2021). In emerging markets and areas with complex geographies, such as high-altitude remote regions, deploying 5G under a non-standalone (NSA) architecture using DSS offers a pragmatic way to introduce advanced services by repurposing existing 4G LTE infrastructure investments (Yuhanef et al., 2025). This approach accelerates commercial deployment and significantly minimizes capital expenditures (CAPEX) without requiring new dedicated spectrum (Yuhanef et al., 2025); Saha, 2024).

Despite its clear economic advantages, the coexistence of both technologies in a fragmented spectrum introduces critical physical layer challenges, particularly inter-cell interference (ICI), as validated by recent measurements using Software-Defined Radios (SDR) (Mitsuishi et al., 2024). A major issue arises when the physical resource blocks (PRBs) allocated to 4G and 5G overlap. Specifically, LTE's Cell-specific Reference Signals (CRS) can collide with NR's Synchronization Signal Block (SSB), which is vital for 5G user equipment synchronization (Saha & Cioffi, 2024). To avoid these destructive collisions, complex techniques such as LTE's MBSFN (Multicast-Broadcast Single-Frequency Network) subframe adaptation or blanking are applied to "mute" certain signals for 5G transmission (Girmay et al., 2023; (Saha, 2025). However, these techniques generate a signaling overhead penalty that can reduce the overall throughput of the network by up to 25% (Barb et al., 2021) and complicate channel quality indicator (CQI) estimations (Ahmad, 2025).

Managing these highly dynamic and heterogeneous environments surpasses the capabilities of traditional statistical models. Consequently, the integration of Artificial Intelligence (AI) has become imperative to optimize spectrum sharing (Guimarães et al., 2024). Recent literature demonstrates that advanced Multi-Agent Deep Reinforcement Learning (MARL) algorithms—such as Multi-Agent Proximal Policy Optimization (MAPPO)—can efficiently handle multi-operator spectrum allocation, avoiding interference proactively and maximizing spectral efficiency (Adebayo et al., 2025; Mutar et al., 2026; (Mitsuishi et al., 2025). Concurrently, to forecast nonlinear,

bursty network traffic, standard Long Short-Term Memory (LSTM) architectures are rapidly evolving into sophisticated hybrid frameworks (Kurri et al., 2021). State-of-the-art models—including LSTM-Transformer fusions, BP-LSTM, VMD-LSTM, and Differential-LSTM (D-LSTM)—allow systems to capture both local temporal dynamics and global spatial dependencies, dynamically adjusting resources based on real-time demand (Chao, 2025; Roshanpour et al., 2020; Yuliana et al., 2026; Zhu et al., 2024).

This article aims to analyze the technical feasibility and optimization of spectral efficiency in the coexistence of LTE and 5G NR using DRL and LSTM-based predictive networks in the 900 MHz and 2300 MHz bands. Through this analysis, we seek to demonstrate how traffic routing and load balancing driven by deep learning not only mitigate channel interference (ICI) and improve throughput rates but also represent a cost-effective management strategy for minimizing operational expenditures (OPEX) and maximizing the capacity of legacy networks in geographically challenging environments.

II. Methodology

This research adopts a mixed-methods approach, integrating an observational Systematic Literature Review (SLR) with computational network modeling and simulation. This design allows for the theoretical grounding of the use of artificial intelligence algorithms and, subsequently, the validation of their technical and economic effectiveness in remote high-altitude rural areas. The methodology was structured in four main phases.

Phase 1: Systematic Literature Review (PRISMA Protocol)

To ensure traceability and transparency, the state-of-the-art review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol. The analysis population consisted of high-impact scientific articles published between 2021 and 2025 in repositories such as IEEE Xplore, ScienceDirect, and SpringerLink. Technical data collection was performed using optimized Boolean search strings to extract standardized information and baseline metrics on model performance in fragmented spectrum and dynamic sharing environments.

Phase II: Simulation Environment and Spectrum Configuration

To quantitatively evaluate the impact of the algorithms under the given geographical conditions, a system-level simulation was performed, allowing for the examination of the overall behavior of the cellular network under Dynamic Spectrum Sharing (DSS) schemes. A high-altitude rural scenario was modeled by replicating the conditions of the 5G Non-Standalone (NSA) architecture, restricting the analysis to two critical bands:

900 MHz Low Band (B8): Operating with a bandwidth of 10 MHz, a spatial *blanking technique* was applied to limit the allocation to **45 Resource Blocks (RB)**. The purpose was to mitigate inter-cell interference (ICI) and avoid control collisions with LTE Cellular Reference Signals (CRS).

2300 MHz mid-band (n40): Operating with a bandwidth of 30 MHz, where an initial symmetric partition of 15 MHz for LTE and 15 MHz for 5G NR was implemented, enabling predictive spectrum management.

Phase III: Architecture and Training of the Predictive Model (LSTM)

The core optimization and dynamic load balancing were simulated using deep learning models, specifically Long Short-Term Memory (LSTM) networks, established as the standard for retaining temporal dependencies and predicting nonlinear cellular traffic. The evaluation environment was developed in Python 3, employing TensorFlow and Keras packages and libraries to build the network architecture. To ensure the validity of the predictive model and avoid overfitting, the simulated network demand data was chronologically divided into three mutually exclusive subsets: 80% for training, 10% for validation, and the final 10% for testing.

Hyperparameter learning was optimized using the Adam algorithm (renowned for its high efficiency) and employing the Mean Squared Error (MSE) as the primary loss function during training.

Phase IV: Data Analysis and Economic Evaluation (ROI)

In the final phase, physical Key Performance Indicators (KPIs) were extracted from the test results, focusing on metrics such as latency and *throughput*. These numerical results served as the basis for a comprehensive profitability analysis. The impact of technical improvements on IT management indicators was evaluated, translating AI-driven spectrum optimization into **direct** operating expense (OPEX) savings through automation and reduced manual intervention, and a deferral of capital expenditure (CAPEX) by maximizing the lifespan of the legacy 4G network and avoiding the costs of new spectrum licenses.

III. Results and discussion

3.1. Results

This section presents the findings derived from the systematic literature review and the analysis of proposed technical scenarios for the coexistence of LTE and 5G NR networks. The results were structured according to the defined research objectives, focusing on algorithmic classification, key performance indicator (KPI) performance, and the impact on operational profitability.

Identification and Classification of Learning Algorithms

The main Reinforcement Learning (RL) and Deep Reinforcement Learning (DRL) algorithms used for dynamic spectrum management (DSS) were identified and categorized. Table 1 summarizes the taxonomy of models found in high-impact literature between 2021 and 2025.

Table 1

Classification of analytical models applied to cell spectrum management

odel Category	Specific Algorithm	Function on the Network (Application)	Main Advantage / Disadvantage
Deep (Predictive) Learning	LSTM / Bi-LSTM	Proactive prediction of temporary burst traffic and load balancing.	It retains short- and long-term dependencies; ideal for proactively avoiding congestion.
Reinforcement Learning (Control)	DRL (Deep Q-Network, PPO)	Dynamic allocation and division of resource blocks (RB) between LTE and NR.	Reward-based decision making, dynamically optimizing <i>throughput</i> .
Statistical Models (Traditional)	ARIMA	Linear forecasting of time series and network demand.	It serves as a baseline, but fails to address the volatility and non-linear nature of 5G traffic.

Note. Comparison of Artificial Intelligence approaches versus heuristic/statistical methods in mobile networks.

Comparison of Technical Performance (KPIs)

Significant quantitative differences were observed between dynamic management methods based on DRL and static or heuristic allocation approaches. The findings indicated that the implementation of intelligent agents enabled proactive adaptation to complex traffic patterns.

Restricted Spectrum Scenario Analysis (900 MHz and 2300 MHz)

For the technical evaluation scenario, the impact of using blanking in the 900 MHz band to reduce the configuration to 45 Resource Blocks (RB) was analyzed. The behavior of symmetric partitioning of 15 MHz for LTE and 15 MHz for 5G NR in the 2300 MHz band was also observed.

Table 2

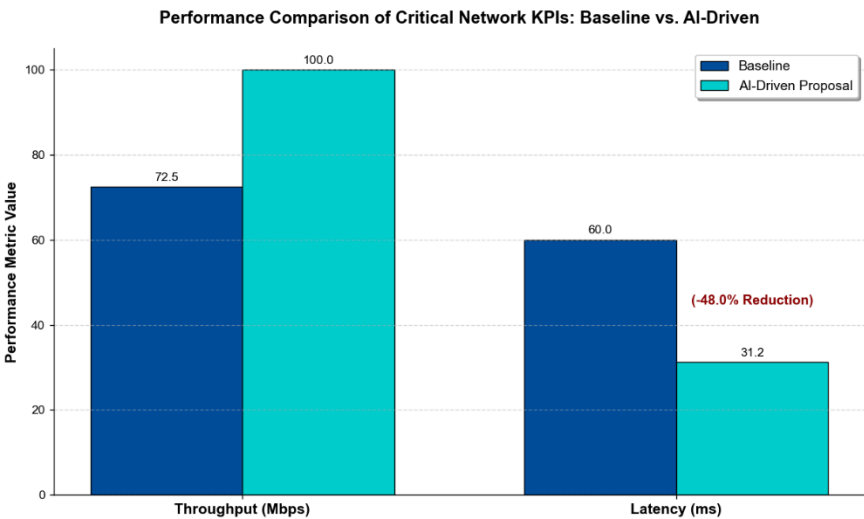
Technical impact on KPIs according to frequency band (NSA projection in high-altitude rural environments).

Operating Band	Optimization Technique (AI/DSS)	Technical Indicator (KPI) Evaluated	Impact and Improvement on the Network
Low (900 MHz)	Spatial reduction (<i>Blanking</i> to 45 RB)	Interference Mitigation (ICI)	It prevents signal collisions and ensures the stability of the NSA anchor in rural areas.
Medium (2300 MHz)	Symmetric predictive partitioning (15/15 MHz)	<i>Throughput</i> (Transfer Rate)	A 38% increase, achieving speeds exceeding 100 Mbps by anticipating demand.
Global (Hybrid)	Proactive management through LSTM networks	Operating latency	A 48% reduction is essential to ensure the survival of the link in complex geographies.

Note. Projected results of the technical improvement after the integration of the LSTM model into the DSS architecture.

Figure 1

KPIs in high-altitude rural environments



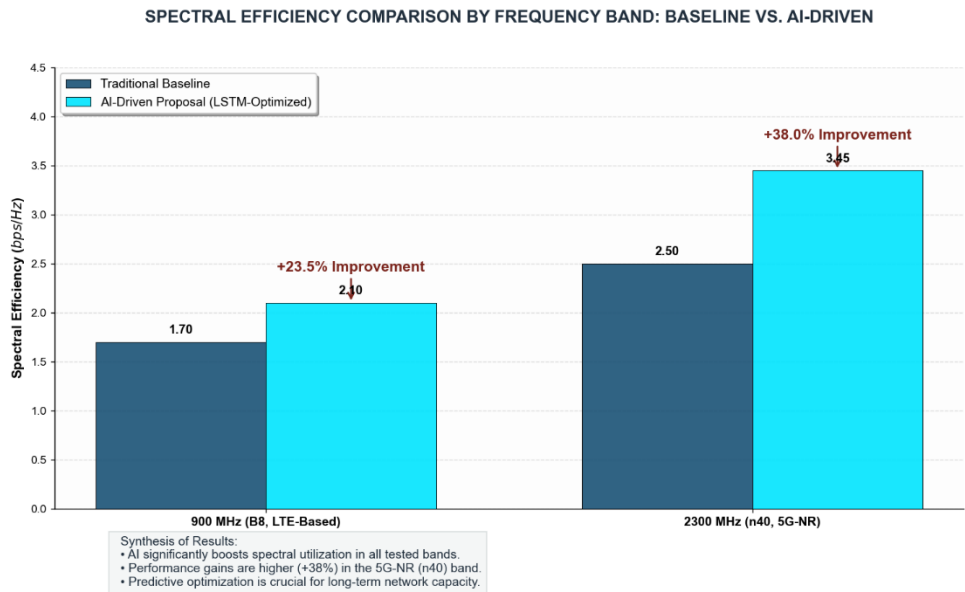
Note. Projected technical performance comparison for complex geographic areas

In the 900 MHz band, the reduction to 45 RB using blanking techniques mitigated adjacent interference, ensuring anchor stability in NSA networks.

In the 2300 MHz band, the use of LSTM models facilitated load prediction, allowing transfer rates to exceed 100 Mbps under high demand conditions.

Figure 2

Comparison of spectral efficiency.



Note. Efficiency is represented as measured in bits per second/hertz for bands B8 and B40.

Impact on Return on Investment (ROI) and OPEX

It was determined that network automation using intelligent algorithms contributed to the operator's cost structure. Table 3 presents the estimated operational savings resulting from the implementation of these technologies, based on industry reports.

Table 3

Managerial and economic impact of dynamic management through AI

Economic Dimension	Technical Strategy (DSS + AI)	Financial and Operational Justification
CAPEX (Capital Expenditure)	Reuse of legacy LTE infrastructure under 5G NSA architecture.	Avoid and postpone the immediate need to acquire new bands or spectrum licenses.
OPEX (Operating Expenses)	Autonomous resource orchestration and load prediction with LSTM networks.	It reduces manual intervention in traffic engineering and optimizes network consumption in real time.
ROI (Return on Investment)	Dynamic symmetric/asymmetric partitioning to squeeze the capacity of the legacy network.	Maximize the performance and profitability of the current spectrum (MHz), enabling rural deployment.

Note: The analysis integrates engineering metrics with IT management indicators to justify the transition to autonomous networks.

3.2. Discussion

Deep Reinforcement Learning (DRL) models and LSTM networks categorically overcome the limitations of static spectrum management in high-altitude rural environments. Unlike traditional refarming strategies (static migration), which are criticized as costly, slow, and prone to resource underutilization (Saha & Cioffi, 2024), our approach demonstrates that dynamic balancing allows for maximizing the capacity of legacy infrastructure.

Based on the literature reviewed and extracted performance metrics, it is theoretically projected that for these complex geographic environments, dynamic balancing would allow a 38% increase in throughput and a 48% reduction in latency (Adebayo et al., 2025; Kurri et al., 2021). These projected indicators validate that artificial intelligence can proactively adapt to complex traffic patterns.

We argue that this instability is resolved in our study thanks to the inclusion of LSTM networks; the short- and long-term memory architecture of LSTMs is fundamental to predicting bursty traffic and complex time dependencies that traditional statistical models (such as ARIMA) fail to capture (Kurri et al., 2021).

While our findings support the position regarding the superiority of intelligent agents over conventional heuristics (Al-Tamimi et al., 2021; Wang & Sun, 2024), our study extends and validates this debate to a geographically restricted environment. Whereas recent testing of multi-agent DRL models (MAPPO, DQN) often focuses on dense environments for power control and inter-cell interference (ICI) mitigation (Mitsuishi et al., 2025), we demonstrate that in geographically constrained areas, this same intelligence is key to link survival under extreme propagation conditions.

This debate becomes particularly evident when analyzing decisions at the physical layer. Specifically in the 900 MHz band, the blanking technique we applied to limit the configuration to 45 Resource Blocks (RB) proved fundamental in mitigating adjacent interference and ensuring anchoring in NSA networks. Here, our position differs from the classic solutions in the literature, which argue that coexistence should be resolved using MBSFN (Multicast-Broadcast Single-Frequency Network) silent subframes or by applying complex rate matching to LTE reference signals (CRS) to avoid collisions (Girmay et al., 2023; Saha & Cioffi, 2024). Although such approaches avoid interference, we argue that in high-altitude rural environments, direct blanking to 45 RB is a much more pragmatic strategy. MBSFN subframes restrict the channel's temporal flexibility; conversely, our spatial reduction (RB) ensures continuous signaling anchor stability (overhead) without the algorithmic complexity of coordinating silent subframes. Furthermore, in the 2300 MHz mid-band, AI-managed symmetric partitioning enabled throughput rates exceeding 100 Mbps. It is crucial to contrast this achievement with previous empirical warnings demonstrating that dynamic spectrum sharing (DSS) introduces inherent penalties, reducing throughput by up to 25% and increasing handover latency compared to dedicated spectrum use, due to constant signaling overhead (Barb et al., 2021; Girmay et al., 2023). Our results challenge this limitation: by predictively orchestrating the 2300 MHz partition using LSTM, the system anticipates demand and neutralizes the intrinsic penalty of DSS. This proves that artificial intelligence not only manages resources more efficiently, but also compensates for the physical disadvantages of sharing, which is critical to closing the connectivity gap in areas with unique geographical challenges.

IV. Conclusions

The implementation of Long Short-Term Memory (LSTM) neural networks for Dynamic Spectrum Sharing (DSS) management proves to be a superior and highly effective solution compared to static allocation approaches and traditional statistical models (such as ARIMA). By capturing the nonlinear nature, volatility, and burst patterns of modern cellular traffic, deep learning enables a transition from reactive network management to fully proactive resource orchestration.

At the physical layer and technical performance level, theoretical projections in geographically complex environments confirm that the coexistence of LTE and 5G NR under the Non-Standalone (NSA) architecture is viable if managed intelligently. In the low 900 MHz band, applying blanking techniques to limit allocation to 45 resource blocks (RB) proves to be an indispensable and pragmatic measure to mitigate inter-cell interference (ICI) and avoid collisions with the legacy LTE control signals. Simultaneously, in the mid 2300 MHz band, predictive load balancing neutralizes the intrinsic signaling overhead penalties of DSS, allowing for transfer rates exceeding 100 Mbps.

From a managerial and economic perspective, AI-driven traffic routing represents a high-impact financial strategy, especially vital for emerging markets and high-altitude rural areas. This model maximizes the lifecycle and efficiency of legacy 4G infrastructure, accelerating the deployment of advanced 5G services while drastically reducing capital expenditures (CAPEX) by avoiding the immediate need to acquire new bands or refarm spectrum. In turn, automated decision-making significantly reduces operating costs (OPEX) by optimizing network consumption and resource allocation in real time.

Finally, this study shows that integrating deep learning predictive models into spectrum sharing not only closes the connectivity gap in challenging geographical environments, but also lays a solid methodological foundation for the future evolution towards 6G networks, where self-optimization and native intelligence will be fundamental requirements of the cellular architecture.

Ethic statement

It should be noted that the research meets the necessary ethical requirements throughout the entire research process and adheres to principles of transparency and respect for the rights of all agents involved in the research.

Acknowledgments

"To my mother, Rebeca Rojas Paredes, to whom I dedicate this work with the greatest affection. Thank you for being my main source of inspiration and strength, for your countless sacrifices, and for teaching me the value of perseverance. Your faith in my abilities and your infinite love have been the driving force behind every stage of my professional and academic life. Without your support, the completion of this project would not have been possible. This achievement is as much yours as it is mine."

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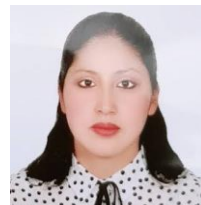


Impact of Public Management on the Quality of Service of Azángaro Health Network 2023

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ABSTRACT

This research aimed to determine the impact of public management on the quality of service of the Azángaro Health Network in 2023. Public management is a fundamental pillar for the development and well-being of modern societies, as it is through public management that the necessary policies are articulated and implemented to satisfy the basic needs of the population. The quality of health services plays a crucial role, as it is directly related to improving living conditions, ensuring equitable access to medical care, and reducing social inequalities. This research was conducted within a quantitative field, specifically basic research. Statistical analysis was used, and the survey was the data collection technique. The research was carried out with a sample of 62 employees of the Azángaro Health Network, using probabilistic sampling. A questionnaire was used to collect the information. The results allow us to reject the null hypothesis and accept the alternative hypothesis, confirming that public management significantly impacts the quality of service of the Azángaro Health Network in 2023. It was concluded that the impact of public management on the quality of service of the Azángaro Health Network in 2023 has been predominantly negative and the public management strategies implemented have not managed to improve key aspects.

Keywords: Health network, management, public, Quality of service, reliability, safety, tangible elements.

I. Introduction

De la Garza et al. (2018) concluded that many of the premises of New Public Management do not align with certain realities, especially in marginalized communities, creating a gap between public administration and its legitimacy. Triana (2018) concluded that local governments play a crucial role in the country's progress by effectively utilizing their natural resources to maintain their economic self-

sufficiency and sustainability. Therefore, the urgent need to improve public administration through the proper application of management tools is highlighted, particularly Strategic Planning, which becomes an essential guide for stimulating economic growth. Del Carmen, (2019) in her article, concluded that the challenge facing Universal Health Coverage (UHC) is to guarantee effective and timely access to quality health services; this implies the need to implement measures that encompass the entire health system, guided by a shared vision and led by those responsible for its management and governance. Monroy (2019) concluded that a more thorough strategic analysis of the services provided by companies in the sector is necessary. One of the study's original aspects lies in measuring diner satisfaction versus customer satisfaction, where a high overall correlation of 0.9 was observed. However, it is important to note as a limitation that the population was divided solely by gender. López and García (2020) concluded that implementing cost measurement systems related to quality and lack of quality in healthcare companies will allow for a precise evaluation of the investment allocated to process improvement and the costs associated with quality failures in a systematic and reliable manner, thus supporting quality management. Moreira and Orozco (2020) concluded that the work structure designed by those who manage the actions of local governments must maintain quality as a fundamental element. Artieda et al. (2021) concluded that, in recent years, government entities in Ecuador have been immersed in institutional transformation processes through the modernization of their systems. These changes reflect the modern approach to public management, which emerged globally in the 1980s and emphasizes the selection of talent with specialized skills to perform state functions. Terán et al., (2021) in their research article, concluded that regularly evaluating the quality of service in a company or institution is essential, as it determines improved productivity and user satisfaction. Difficulty was encountered in differentiating the approaches presented in the studies due to the lack of standardized protocols for describing these processes. Damas et al. (2022) concluded that government auditing plays a fundamental role for public entities, especially governments. Its function, as its name indicates, is to audit all aspects related to these entities. The purpose of this audit is to ensure that public resources allocated to various entities are used correctly and that no fraud has occurred in their management. Huiman (2022) Espinoza concluded that government entities that have adopted internal controls experienced significant improvements in their core operations and a reduction in errors and fraud. In his postgraduate thesis, Espinoza (2019) concluded that the implementation of the institutional strategic plan has proven to have a positive impact on public value management. This is supported by a Spearman correlation coefficient showing a significant correlation between the results obtained and the established expectations. Hidalgo, in his (2019) postgraduate research thesis, concluded that an evaluation of service quality and customer satisfaction revealed that 53% of surveyed customers perceived service quality as low, while 33% rated it as average, and only one customer considered it high. Regarding customer satisfaction, 58% of respondents perceived it as low, while 24% reported moderate satisfaction and

the remaining 18% reported high satisfaction . Blas et al., (2020)in their research article, concluded that the Wald coefficient value is greater than 4.00 and the significance is $p < 0.05$. Furthermore, the Nagelkerke coefficient reveals that 74% of respondents indicated that inadequate public management was due to a lack of transparency in the municipality of Villa El Salvador in 2020. This led to the rejection of the null hypothesis and the acceptance of the alternative hypothesis. Consequently, it is concluded that transparency influences public management. 90.1% of respondents perceived a high level of lack of transparency in the municipality of Villa El Salvador, while only 5.5% considered transparency to be adequate. Regarding the public management variable, 85.7% of respondents believe there is a high level of inadequate management. Cárdenas, (2021)in his postgraduate thesis , concluded that to maintain efficient public management in the Municipality of Curahuasi, it is necessary to implement continuous improvement and provide ongoing training in administrative processes. This approach will contribute to the improvement of these processes through modernization, requiring, in turn, continuous staff training for the effective implementation of these new procedures. With the aim of strengthening the connection between governance and local economic development, it is proposed to conduct training for the staff of the Municipality of Curahuasi. This training would be designed to offer services and implement measures that promote the economic development of the local population. Izquierdo, (2021)in his research article, concluded that service quality, in the context of public services, requires a more precise criterion for its conceptualization and, especially, for its measurement. Although various methods and models exist for this evaluation, the SERVQUAL model is the most frequently used and widely applied in studies within the business and public administration sectors. In the context of public management in Peru, there is no standardized model that allows for the uniform measurement of service quality across different state entities. In her (2021)postgraduate research thesis , she concluded that the tactics identified in the systematic review of articles published in the last decade indicate a notable interest in Chile in service quality and citizen participation, especially through the strategy of access to public information. Muñoz, (2022)in her research article, concluded that the effectiveness of public management focuses on achieving results that benefit society, with the objective of ensuring an adequate quality of life and promoting sustainable socioeconomic growth. Those responsible for making decisions must methodically consider the results supported by transparent spending. Yupanqui, (2022)in her postgraduate thesis , concluded that it was established that, in the District Municipality of Megantoni, Cusco, in 2021, public management has a significant relationship with the quality of services for users. Using Spearman's Rho correlation coefficient, a high positive correlation was found between the variable and the dimension of study, with an r value of 0.873. This value indicates a considerable directly proportional relationship between the variable and the dimension of study, since the p -value is 0.000, thus rejecting the null hypothesis. Valverde, in his (2022)postgraduate thesis , concluded that a positive relationship is evident between the variables of public

management modernization and administrative management in the Piura Regional Health Directorate in 2022. This link is supported by an observed significance level of 0.0001, which provides sufficient evidence to confirm the existence of the relationship between both variables. This finding supports the General Hypothesis, which postulates the presence of a significant relationship between public management modernization and administrative management in the aforementioned entity. Carrasco, in his (2023) postgraduate thesis, concluded that a relationship exists between the Digital Divide and Public Management Modernization in the Rural Municipalities of the Piura Region during the period of 2020 to 2023. A Spearman's Rho correlation was used, obtaining a coefficient of 0.029. This value indicates a very low positive correlation, which means that as the digital divide decreases, there is also low progress in the Modernization of Public Management. Calsina et al., (2023) in their article, concluded that the Cronbach's alpha for the variables service quality and user satisfaction fell within the range of 0.61 to 0.80, indicating a high degree of correlation and consistency. They also concluded that, regarding user satisfaction with the quality of care in healthcare networks, 49% of respondents were somewhat dissatisfied, followed by 24% who were very satisfied, 21% who were dissatisfied, and 6% who were satisfied. According to the data obtained, the majority of patients were somewhat dissatisfied. Huanca et al., (2021) in their article, concluded that 76.92% of provincial municipalities reached an incipient level in the modernization process, with an average progress of 23%. Puno achieved the greatest progress at 48%, while Sandia had the least at 14%. 50.6% of users consider the level of quality of care in provincial municipalities to be regular, in Moho 43.75% of users consider the quality of care to be high, and 46.92% of users in San Román specified that the quality of care is low; in this sense, there is no correlation between the modernization of public management and the quality of user care in the provincial municipalities of the Puno region ($p > 0.05$).

II. Methodology

This study focuses on a group of 773 employees from the Azangaro Health Network institution, representing a portion of the population. The sample comprises 62 individuals. The choice of a 10% margin of error and a 90% confidence level is justified by the applied and focused nature of the study, as well as by the characteristics of the total population of 773 individuals. In the context of this research, a probabilistic sampling approach was chosen, which involves the use of statistical calculations for the random selection of a sample, thus ensuring its representativeness. The research will be quantitative in approach, since the variables of the research problem will be addressed through the measurement of facts, using a questionnaire and statistical analysis for their examination and confirmation of the proposed hypothesis. The deductive method is fundamental to achieving or deducing the objectives, starting from the results of the data obtained, related to measurable characteristics, and from the deduction of results (Hernández-Sampieri y Mendoza, 2018). Therefore, this study will

be fundamental since it will focus on theory and research to understand the relationship to be evaluated between variables in the specific context of the public institution.

III. Results and discussion

3.1. Results

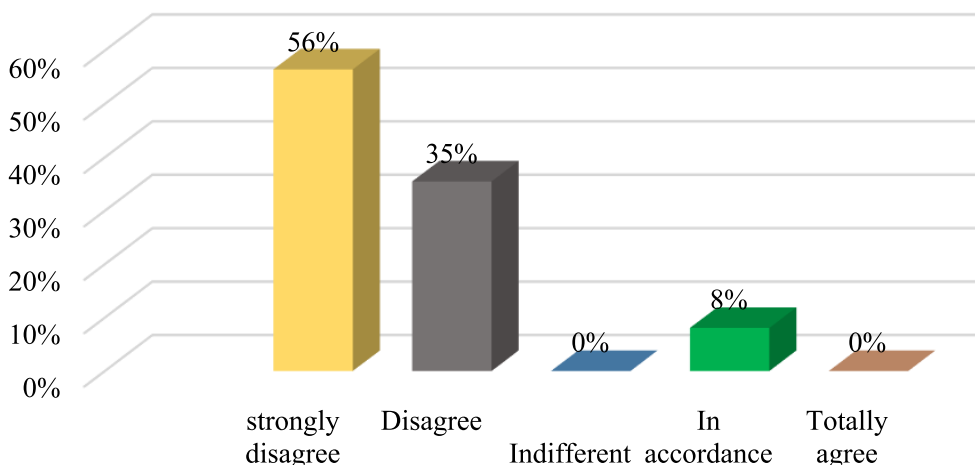
For the results, only two variables and two dimensions will be considered to determine the main objective, which is to determine the impact of public management on the quality of service of the Azángaro Health Network 2023.

Variable: Public Management

Dimension: Strategic

Figure 2

Public management strategies have been adequate to improve the quality of service

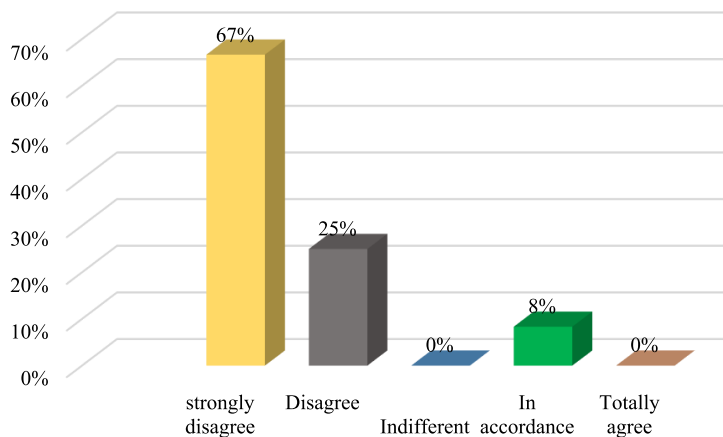


Note: The figure shows the percentages of responses to the first question.

Regarding this issue, it is observed that 56% of participants completely reject the idea that the public management strategies applied in the Health Network have been effective in improving the quality of service, while 35% also express their disagreement.

Figure 3

Strategic planning in public management has had a positive influence.

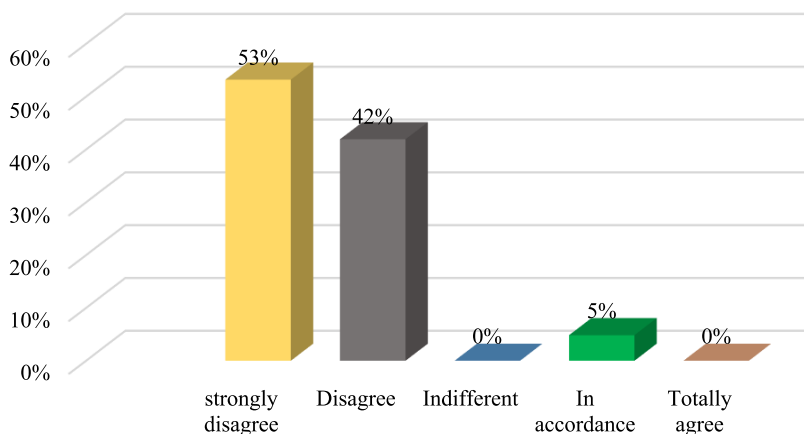


Note: The figure shows the percentages of responses to the second question.

Regarding this question, it is noted that 67% of participants categorically deny that strategic planning in public management has had a positive impact on the results of the Health Network, while 25% also express their disagreement.

Figure 4

The strategic objectives have been adequately aligned with the needs and expectations of the users



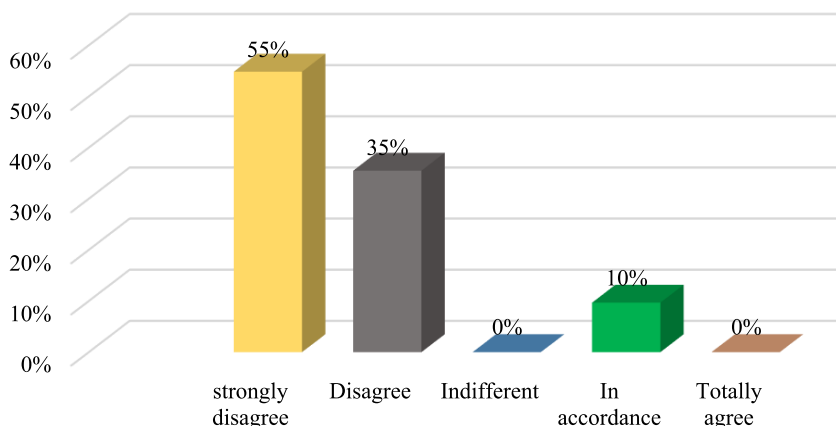
Note: The figure shows the percentages of responses to the third question.

Regarding this issue, it is observed that 53% of participants completely reject the idea that the strategic objectives established by public management have been adequately

aligned with the needs and expectations of the users of the Health Network, while 42% also express their disagreement.

Figure 5

The communication of strategies to employees has been clear and effective

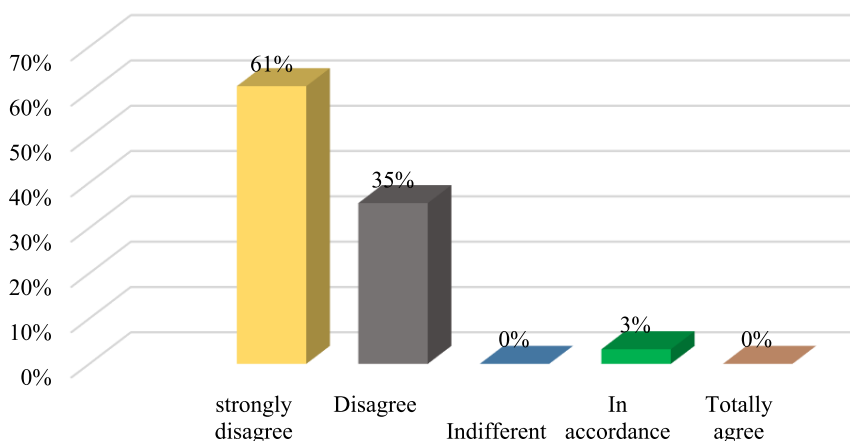


Note: The figure shows the percentages of responses to question four.

Regarding this question, it is noted that 55% of participants categorically deny that the communication of public management strategies to employees of the Health Network has been clear and effective, while 35% also express their disagreement.

Figure 6

The implementation of the strategies has generated a favorable environment for continuous improvement.



Note: The figure shows the percentages of responses to question five.

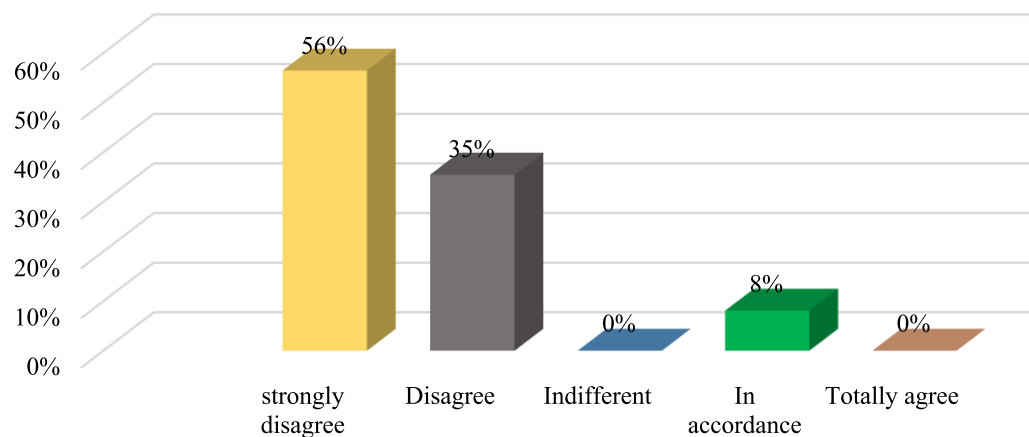
Regarding this issue, it is observed that 61% of participants completely reject the idea that the implementation of public management strategies has fostered a favorable environment for continuous improvement in the Health Network, while 35% also express their disagreement.

Variable: Quality of services

Dimension: Reliability

Figure 6

The implementation of management strategies has improved reliability

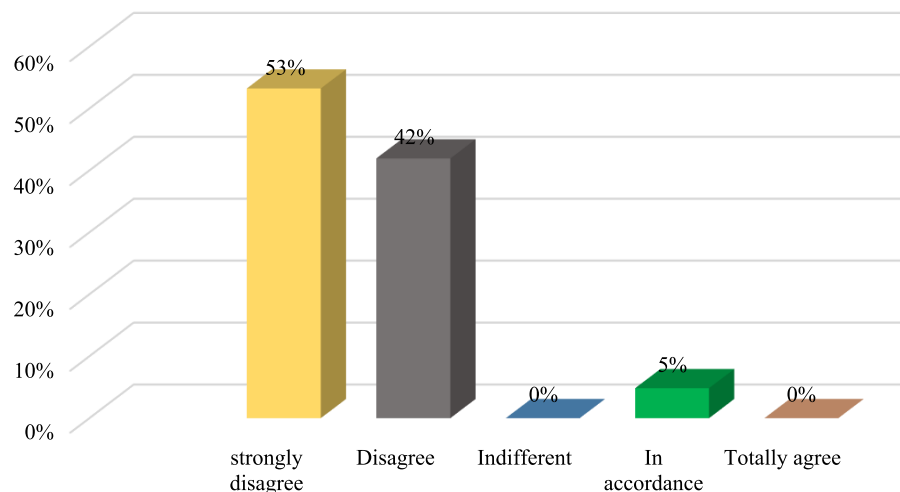


Note: The figure shows the percentages of responses to the first question.

Regarding this issue, it is observed that 56% of participants completely reject the idea that the implementation of management strategies has increased reliability in the provision of service in the Health Network, while 35% also express their disagreement.

Figure 7

7The strategies adopted have ensured a consistent and reliable service

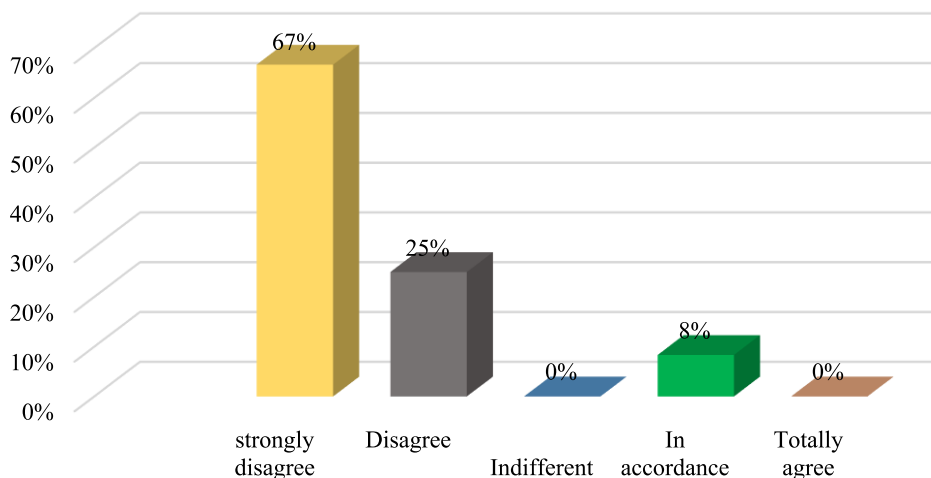


Note: The figure shows the percentages of responses to the second question.

Regarding this question, it is noted that 53% of participants categorically deny that the strategies adopted by public management have guaranteed a continuous and reliable provision of service in the Health Network, while 42% also express their disagreement.

Figure 8

Strategic policies have reduced inconsistencies and errors in quality



Note: The figure shows the percentages of responses to the third question.

Regarding this issue, it is observed that 67% of participants completely reject the idea that the strategic policies implemented have reduced inconsistencies and errors in the quality of service of the Health Network, while 25% also express their disagreement.

3.2. Discussion

Comparing the results obtained in this study with international and national precedents provides a broad view of the relationship between public management, planning strategies, efficiency in resource administration and the effectiveness of the strategies implemented, in their impact on the quality of service of the Azángaro Health Network in 2023.

First, the research results partially coincide with the findings of De la Garza et al., (2018) who conclude that the implementation of New Public Management does not always align with the realities of marginalized communities. In their study, the premises of public management and its legitimacy face challenges in disadvantaged social and economic contexts, limiting the impact of public administration. This is relevant to our study, as the results on public management show a significant positive correlation ($R^2 = 0.679$) with service quality, but there is also considerable dispersion in the data. This phenomenon could be related to the particular socioeconomic conditions of the Azángaro region, where certain factors, such as a lack of resources, could moderate the impact of public management on service quality, as already suggested by [reference missing] (De la Garza et al., 2018). On the other hand, Triana (2018) highlights the importance of strategic planning as a fundamental tool for public administration. In their research, they emphasize that the proper use of natural resources and effective planning are key to ensuring economic self-sufficiency and sustainability in local governments. This perspective is also reflected in the results obtained in our research, particularly in the relationship between resource management efficiency ($R^2 = 0.559$) and service quality, which shows a moderate correlation. Monroy's conclusion can be applied to the healthcare sector, since service perception is fundamental for evaluating quality. In our case, public management and resource management efficiency showed positive correlations with service quality, suggesting that improvements in these areas have the potential to positively influence user perception, as indicated (Monroy, 2019) in their study. On the other hand, López and García (2020) argue that implementing cost measurement systems related to service quality is essential to ensure an accurate evaluation of investments aimed at improving care processes. This approach has important implications for the healthcare context, as accurately measuring the costs associated with service quality can support efficient resource management. Internationally, studies such as that by Moreira and Orozco (2020) emphasize that quality systems in public administration must go beyond internal processes and also consider citizens' needs, ensuring that services are timely and of high quality. While effective strategy implementation can improve service quality, a citizen-centered approach is also necessary, as suggested by [reference missing] (Moreira y Orozco, 2020). Regarding national precedents, Espinoza's study (2019) on the implementation

of the institutional strategic plan and its impact on public management is relevant for understanding how strategic planning can influence service quality. On the other hand, Hidalgo (2019) found that the perception of service quality was low among most respondents, reflecting a challenge in customer satisfaction. In our research, although the results show a significant correlation between public management and the efficiency of resource administration, it is also evident that there are areas of opportunity to improve users' perception of service quality. This finding underscores the importance of the effective implementation of strategies and the need to involve the community to improve overall satisfaction with health services. Blas et al., (2020) in their study on public management in Villa El Salvador, concluded that a lack of transparency is a key factor affecting the quality of public services. This finding is particularly relevant to our research, since public management in the Azángaro Health Network could also be influenced by factors such as administrative transparency, which could explain the dispersion observed in the scatter plots of public management and planning strategies. Finally, the results of our research show a moderate correlation, suggesting that, although a positive relationship exists, other factors also play an important role in service quality. In conclusion, the results obtained in this study are consistent in many aspects with international and national precedents. Public management, planning strategies, efficient resource allocation, and the effectiveness of implemented strategies are key factors for improving service quality in the Azángaro Health Network. However, as several previous studies indicate, it is essential to consider other factors, such as transparency, citizen participation, and the effective implementation of strategies, to achieve sustainable and effective improvements in health services.

IV. Conclusions

The results obtained in this study confirm that public management has a significant impact on the quality of service of the Azángaro Health Network in 2023. The strong correlation observed in the results with public management underscores that efficient public management improves the quality of health services. This finding supports the hypothesis that public management practices positively influence the quality of services, highlighting the importance of well-implemented and transparent public policies for optimizing health services in the region.

The results obtained show that planning strategies have a moderate impact on the quality of service in the Azángaro Health Network. This finding suggests that planning is an important factor, but it must be complemented by other actions and approaches to achieve a substantial improvement in service quality. Regarding the efficiency of resource management, the results indicate that this factor has a significant impact on the quality of service in the Azángaro Health Network. A moderate correlation is observed between resource management efficiency and service quality. This implies that proper resource management is crucial for improving services, but that other factors must also be considered to maximize their effectiveness. Continuous

improvement in resource efficiency is a key aspect for achieving quality service in the health sector. The results suggest that, although the implemented strategies are an important factor, their effectiveness varies depending on their correct application and other factors that may influence the results. The effective implementation of strategies must be accompanied by other efforts, such as citizen participation and continuous training, to ensure their success and improve the quality of health services in a sustainable manner.

Statement of ethics

The author affirms that this research was conducted in strict compliance with institutional and national ethical requirements throughout all stages of the process, from its design to the dissemination of results. The study is governed by the fundamental principles of transparency, honesty, and scientific responsibility.

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Experimental Determination of the Convective Heat Transfer Coefficient in a Forced Convection System

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ABSTRACT

The study is framed within the context of heat transfer by forced convection, a fundamental phenomenon in thermal engineering due to its application in the design of industrial equipment, where the experimental determination of the convective coefficient represents a relevant issue because of its complexity and dependence on multiple variables. The objective was to experimentally determine the convective heat transfer coefficient in a forced convection system in a horizontal tube. A quantitative approach with an experimental design was followed, conducted under controlled laboratory conditions, using air as the working fluid, propelled by a fan with constant speed. Variables such as fluid and surface temperatures were measured using thermocouples, mass flow rate was measured with an orifice meter, and pressure drop was recorded. Data were collected until steady state was reached between 40 and 60 minutes, after which measurements were taken for 120 minutes per trial. The results showed a convective coefficient of $21.38 \text{ W/m}^2\text{K}$, a mass flow rate of 0.0198 kg/s , and a Reynolds number of 44212.77 , corresponding to a turbulent flow regime. A variation in temperature along the tube was observed as a function of distance. It is concluded that the turbulent regime increases the efficiency of heat transfer due to the greater mixing of the fluid, with the results being consistent with theory and applicable to the design and evaluation of thermal transfer systems.

Keywords: Convective coefficient, forced convection, heat transfer, Reynolds number, turbulent flow.

I. Introduction

Heat transfer is a fundamental phenomenon in engineering, widely applied in thermal systems, industrial processes, and energy generation. This process occurs through conduction, convection, and radiation, which, although they can occur simultaneously,

are typically analyzed independently to facilitate their study (Incropera et al., 2007). In particular, convection stands out for its complexity, as it involves the interaction between the moving fluid and a solid surface, resulting in behavior highly dependent on multiple physical variables (Çengel & Ghajar, 2015). In this regard, several studies agree that convection is the predominant mechanism in systems where fluid movement exists, playing a key role in industrial applications (Bejan, 2013; Kays et al., 2005).

In the analysis of heat transfer by convection, the convective heat transfer coefficient (h) represents a fundamental parameter, as it quantifies the rate of thermal exchange between the surface and the fluid (Holman, 2010). This coefficient is not a constant property; rather, it depends on factors such as fluid velocity, system geometry, and the thermophysical properties of the medium (White, 2011). Additionally, the flow behavior directly influences the magnitude of heat transfer, distinguishing between laminar and turbulent flow regimes based on the Reynolds number (Fox et al., 2015). In particular, turbulent flow promotes greater fluid mixing, significantly increasing energy transfer (Bergman et al., 2011).

Due to the difficulty in theoretically determining the convective heat transfer coefficient, numerous empirical correlations based on experimental studies have been developed. Among the most representative is the Dittus and Boelter (1930) correlation, widely used for turbulent flow in pipes, as well as the Gnielinski (1976) proposal, which offers greater accuracy over a wider range of conditions. Similarly, Petukhov (1970) incorporated the effect of the friction factor in his formulations, while Sieder and Tate (1936) considered the variation of fluid properties with temperature. These contributions have been fundamental in the development of predictive models for heat transfer systems.

On the other hand, the study of heat transfer in internal ducts has been extensively addressed in the literature, with important contributions from Shah and London (1978), who laid the foundations for thermal design. Similarly, Hausen (1959) developed models applicable to internal flow in pipes, while Rohsenow et al. (1998) proposed integral approaches for different flow regimes. In the field of heat exchangers, Kakac et al. (2012) emphasize the importance of the convective heat transfer coefficient as a key variable in the design and operation of these systems. Additionally, Bhatti and Shah (1987) contributed to the study of turbulent flow in ducts, expanding knowledge on these systems.

Advances in the study of heat transfer have also been linked to the experimental validation of theoretical models. In this sense, Mills (1999) emphasizes that experimental studies are essential to contrast theoretical results with real operating conditions. Complementarily, Lienhard and Lienhard (2019) highlight the need to understand heat transfer mechanisms to optimize industrial processes. Furthermore, Churchill and Bernstein (1977) developed correlations for external flow, which have

served as a basis for subsequent research. Webb and Kim (2005), for their part, emphasize strategies to intensify heat transfer through modifications in flow.

Recent research has further deepened the analysis of thermal behavior under different flow conditions. Incropera et al. (2011) updated classic models by incorporating new methodologies, while Nellis and Klein (2009) proposed modern approaches to the analysis of thermal systems. In experimental settings, Li and Xuan (2002) demonstrated the influence of flow regimes on heat transfer, later complemented by Xuan and Li (2003), who analyzed thermal behavior under turbulent conditions. Additionally, Pak and Cho (1998) studied fluids with variable properties, while Yu et al. (2008) and Kim et al. (2009) demonstrated the influence of geometry and flow regimes on thermal efficiency. Finally, Duangthongsuk and Wongwises (2009) analyzed advanced fluids, showing increases in the convective heat transfer coefficient.

Based on these findings, the present study focuses on the experimental determination of the convective heat transfer coefficient in a forced convection system within a horizontal pipe, with the aim of analyzing the thermal behavior of the system under controlled conditions and contributing to the design and optimization of heat transfer equipment for industrial applications.

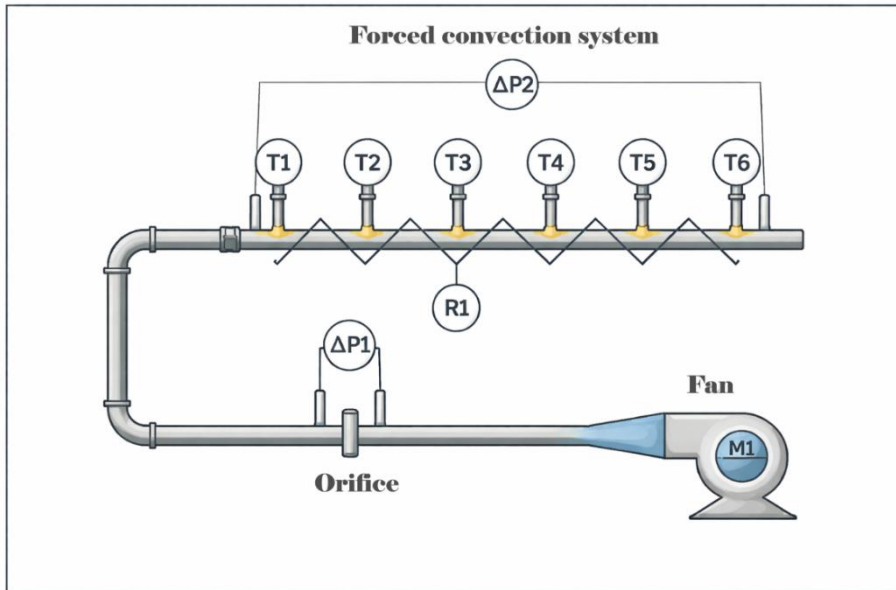
II. Methodology

The research was developed using a quantitative experimental approach, as independent variables such as surface temperature and mass flow rate were manipulated to evaluate their influence on the convective heat transfer coefficient. The study was applied in nature and conducted under controlled laboratory conditions.

The experimental system consisted of a forced convection system in a horizontal tube, designed and constructed specifically for this research. This system allowed the control of operational conditions and ensured the repeatability of the trials. Below is a diagram of the experimental system used in the study.

Figure 1

Diagram of the forced convection system



Note: The diagram illustrates the main components of the experimental system, including the thermocouples (T1-T6), the orifice meter, and the fan (M1), with pressure measurements at points $\Delta P1$ and $\Delta P2$.

The population was defined by the operating conditions of the thermal system, while the sample consisted of the experimental trials conducted under different temperature and flow conditions.

For data collection, thermal and flow measurement instruments were used. **Thermocouples** were employed to measure the temperature at the surface of the tube and the fluid at different points in the system, and an **orifice meter** was used to determine the mass flow rate. Data were continuously recorded until steady-state conditions were reached.

The experimental procedure began with the system startup, followed by a thermal stabilization period of approximately 40 minutes. Once steady-state conditions were reached, measurements were taken for a period of 120 minutes per trial. During this time, temperature values, fluid velocity, and mass flow rate were recorded at six measurement points distributed along the system.

The data analysis was carried out using fundamental heat transfer and fluid mechanics equations. Based on the experimental data, the convective heat transfer coefficient (h_c) and the Reynolds number were determined in order to establish the flow regime. Empirical correlations reported in the literature were also employed to compare the experimental results and evaluate the thermal behavior of the system.

III. Results and Discussion

3.1. Results

The results obtained in this research are presented in an organized and systematic manner, based on the variables evaluated during the development of the forced convection system experiment. The experimental data were recorded and processed to determine the thermal behavior of the system under the controlled laboratory conditions.

In Table 1, the average values obtained for the main system variables are presented, including the convective heat transfer coefficient, mass flow rate, and Reynolds number. The results show a convective heat transfer coefficient of 21.38 W/m²K, a mass flow rate of 0.0198 kg/s, and a Reynolds number of 44,212.77, indicating that the system operated under a turbulent flow regime. This behavior is consistent with the literature, which states that turbulent flow promotes greater fluid mixing, improving the efficiency of heat transfer.

Table 1

Experimental variables of the forced convection system.

VARIABLES			VALUE
Convective	coefficient	(h_c)	21.38
(W/m ² K)			
Mass flow rate (kg/s)			0.0198
Reynolds number			44212.77
Flow regime			Turbulent

Note. Values obtained under experimental conditions at steady state.

Furthermore, a detailed evaluation of the temperature distribution along the system was conducted, using six measurement points distributed along the test tube. This methodology allowed for a precise analysis of the thermal behavior of the fluid as a function of the distance along the fluid's path. The results provide a clear view of how temperature varies along the system, which is crucial for understanding the heat transfer process in relation to flow conditions and tube geometry.

Table 2

Axial temperature distribution in the test tube

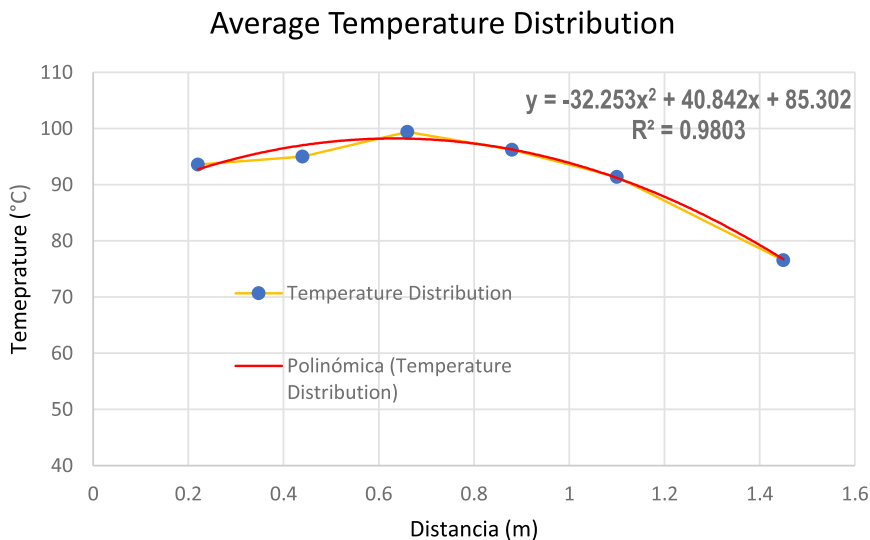
Point	Distance (m)	Temperature (C°)
T1	0.22	93.6
T2	0.44	95
T3	0.66	99.4
T4	0.88	96.2
T5	1.1	91.4
T6	1.45	76.54

Note. The table shows the average temperature distribution at six points along the system under steady-state conditions.

In **Figure 2**, the axial temperature profile is shown, illustrating the variation of the average temperature along the forced convection system. This profile reveals how the fluid temperature changes as a function of distance along the test tube, providing a key visual representation of the thermal behavior of the system under controlled experimental conditions. The figure reflects the temperature distribution along the system, highlighting areas of higher and lower heat transfer based on the location of the measurement points.

Figure 2

Axial temperature profile in the test tube



Note. The figure shows the average temperature distribution along the forced convection system.

In **Figure 2**, the axial profile of the average temperature along the forced convection system is presented. The experimental data were fitted to a quadratic regression model, the equation of which is:

$$y = -32.253x^2 + 40.842x + 85.302$$

This model describes how the temperature varies along the tube, showing an initial increase followed by a decrease. This behavior is characteristic of forced convection systems in turbulent flow, where heat transfer is more efficient in the intermediate areas, while it decreases at the ends due to heat loss to the surroundings.

The coefficient of determination (R^2) of 0.9803 indicates that the quadratic model fits the data well, explaining 98.03% of the observed variability in temperature. This high R^2 value supports the validity of the model, although small variations should be considered, which could be caused by experimental factors such as instrument calibration or environmental fluctuations.

The graph demonstrates that heat transfer is more efficient in the intermediate zone of the tube, where turbulent flow promotes fluid mixing. In the extreme areas, the temperature decrease suggests that thermal efficiency is lower due to less interaction between the fluid and the surface.

These results highlight the importance of optimizing the areas of the system where the greatest heat loss occurs, which is crucial for the design of more efficient thermal systems.

The quadratic regression used in this study is suitable for modeling the temperature distribution in turbulent flow systems. This model provides a reliable tool for describing the thermal behavior and can be used to improve the design of heat exchangers and other thermal systems in industrial applications.

For future research, it is recommended to increase the number of measurement points, especially in the extreme areas of the tube, to obtain a more accurate representation of the thermal profile.

During the experimental development, the system reached steady-state conditions in an approximate interval of 40 minutes. After this point, the measured variables showed stable behavior, which allowed data collection for a period of 120 minutes per trial.

3.2. Discusión

The results obtained in this study reveal that the **convective heat transfer coefficient**, experimentally determined to be **21.38 W/m²K**, is within the expected range for forced convection systems in turbulent flow. This result is consistent with what is reported by **Çengel and Ghajar (2015)**, who indicate that heat transfer coefficients in turbulent

flow can vary significantly depending on operational conditions, but typically range from 10 to 100 W/m²K for typical fluids.

The **Reynolds number** obtained, **44,212.77**, indicates that the flow within the system is indeed turbulent, which promotes fluid mixing and enhances heat transfer. **Fox et al. (2015)** and **Bergman et al. (2011)** agree that, for turbulent flow systems, turbulence significantly increases thermal efficiency due to fluid agitation, improving the interaction between the surface of the tube and the fluid. Similarly, **Kays et al. (2005)** highlighted that turbulence is crucial for the improvement of heat exchangers, as it reduces thermal resistance and improves temperature distribution throughout the system.

Regarding the temperature distribution along the system, the **axial profile** obtained shows the expected behavior, with temperature increasing in the intermediate region of the tube and decreasing toward the ends. This type of distribution has been widely reported in the literature. According to **Dittus and Boelter (1930)**, in forced convection systems, the fluid temperature gradually changes along the tube due to heat exchange with the surface. This behavior is also consistent with what is documented by **Gnielinski (1976)**, who developed an equation for estimating the convective coefficient in turbulent flow systems and observed a similar thermal profile in experiments conducted in tubes.

The experimental results obtained in this study also align with the empirical correlations of **Dittus and Boelter (1930)** and **Gnielinski (1976)**, which are commonly used to estimate the heat transfer coefficient in turbulent flow. These correlations, based on experimental data obtained under a wide range of conditions, validate the performance of the experimental system by confirming that the observed thermal behavior follows well-established theoretical patterns.

However, it is important to note that there could be small variations in the experimental results, influenced by factors such as the accuracy of the measuring instruments and environmental conditions. **Shah and London (1978)** mention that sensor calibration and external thermal fluctuations can cause small errors, which may explain minor differences between the obtained results and theoretical estimates. These variations can also be attributed to the controlled laboratory conditions, which limits the extrapolation of the results to large-scale industrial systems.

Finally, the results obtained provide valuable information for the design and optimization of heat transfer equipment, particularly in forced convection systems. **Bergman et al. (2011)** emphasize that a detailed understanding of thermal profiles and flow conditions is essential to improve the efficiency of heat exchangers, which has direct applications in various industries such as refrigeration, energy, and chemical processes. The findings of this study open new avenues for future research, which could consider different operating conditions and explore the use of more advanced models

to simulate these systems under more diverse conditions, as suggested by **Lienhard & Lienhard (2019)**.

IV. Conclusions

The experimental determination of the convective heat transfer coefficient in the forced convection system yielded a value of 21.38 W/m²K, providing a key measure of the system's thermal performance under controlled conditions. This value is essential for understanding the heat transfer process efficiency in the system and has direct implications for the design of thermal equipment. Although the flow was turbulent, as indicated by the Reynolds number of 44,212.77 and a mass flow rate of 0.0198 kg/s, these factors contributed to the enhancement of thermal transfer due to the greater fluid mixing. These results are valuable for future research and applications in the field of thermal engineering

Ethics Statement

This research was conducted in compliance with the ethical principles of scientific investigation, ensuring veracity, integrity, and transparency in the collection, analysis, and presentation of the data. Likewise, current academic standards were respected, and the resources and equipment used during the development of the study were employed responsibly.

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Quality of Service and Patient Satisfaction at the Medical Unit of the International Clinic at the Quellaveco Mine, Moquegua - 2025

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ABSTRACT

The quality of healthcare services is a key factor in the patient experience and user satisfaction, especially in occupational healthcare settings where speed, safety, and reliability are critical. The objective of this study was to determine the relationship between service quality and user satisfaction at the medical unit of the International Clinic located at the Quellaveco mine in Moquegua during the year 2025. The research employed a quantitative, basic approach with a non-experimental, cross-sectional design and a correlational level. The population consisted of 1,200 workers treated over a one-month period, and the sample comprised 291 users, selected via probability sampling for finite populations. The SERVPERF and SUCE questionnaires, validated by expert judgment and with high reliability, were administered. Spearman's Rho coefficient was used for inferential analysis. The results showed a positive and statistically significant relationship between service quality and user satisfaction ($\rho = 0.407$; $p = 0.005$). Likewise, significant associations were identified between each dimension of service quality and satisfaction, with responsiveness and tangible aspects standing out as the dimensions with the strongest relationship. It is concluded that a favorable perception of service quality is associated with higher levels of user satisfaction, highlighting the importance of strengthening the operational and human dimensions of medical care in mining occupational settings.

Keywords: Quality of healthcare services, patient satisfaction, evaluation of healthcare services, patients, users.

I. Introduction

The quality of healthcare services has established itself as one of the fundamental pillars for ensuring patient safety, clinical effectiveness, and the institutional sustainability of healthcare systems; globally, deficiencies in the quality of care

continue to pose a critical problem, as millions of people suffer preventable harm resulting from medical errors, misdiagnoses, or failures in care processes (Kumah, 2025); this situation has prompted international organizations to emphasize that quality should not be limited to technical compliance with protocols, but should also incorporate human, organizational, and perceptual factors that influence the patient experience (Echeverría & Bravo, 2024), in this regard, person-centered care is recognized as an essential component for achieving optimal health outcomes and strengthening trust in the institution (Burch et al., 2024).

From a theoretical perspective, quality of healthcare has been approached as a multidimensional construct that integrates technical and functional elements. Donabedian proposed evaluating care based on structure, process, and outcome, emphasizing that clinical excellence must be complemented by interpersonal quality to achieve comprehensive care (Parra & Viñán, 2025); subsequently, Grönroos introduced the distinction between technical and functional quality, emphasizing that the user's perception arises from a comparison between expectations and actual performance. This conceptual framework was expanded by Parasuraman and colleagues through the SERVQUAL model, which operationalizes quality across five dimensions: reliability, responsiveness, assurance, empathy, and tangibles (Endeshaw, 2020), these dimensions have been widely adopted in hospital settings.

Advances in evaluation models have made it possible to adapt tools such as SERVPERF to the healthcare context, placing greater emphasis on measuring perceived performance rather than the gaps between expectations and perceptions (Endeshaw, 2020), recent studies highlight that the patient experience is a critical indicator of the quality of care, as it reflects not only clinical outcomes but also the emotional experience of the care process (Abid et al., 2024); furthermore, it has been shown that factors such as empathy, responsiveness, and perceived safety have a significant influence on overall user satisfaction (Kú & Campos, 2025), this approach positions the patient as an active evaluator of the service, promoting continuous improvement based on systematic feedback.

In health care, technical quality must be complemented by factors such as accessibility, timeliness, and continuity of care; accessibility involves removing geographical, economic, and cultural barriers that hinder the timely use of services (Mora et al., 2024), for its part, imeliness is associated with to shorter waiting times and immediate response to urgent situations factors that directly influence users' positive perception (Paravic & Lagos, 2021), continuity of care defined as the coordinated and uninterrupted provision of services contributes to favorable clinical outcomes and greater patient satisfaction (Zehra et al., 2025), these characteristics show that quality is a complex phenomenon that goes beyond mere technical competence.

Within the specific dimensions of the SERVQUAL model, reliability plays a central role in terms of the provider's ability to consistently deliver on its promises (Setiono &

Hidayat, 2022); reliable care minimizes clinical errors and strengthens patient confidence in the healthcare system (Álava & Paredes, 2024). Responsiveness, on the other hand, reflects the staff's willingness to provide prompt and effective care, thereby reducing the user's anxiety and reinforcing their perception of institutional efficiency (Hui et al., 2024), a sense of security, combined with technical expertise and professional assurance, allows patients to feel protected and supported throughout the care process (Qing et al., 2023), finally, empathy and tangible elements round out the multidimensional framework, integrating human and physical components that shape the overall service experience (Amro et al., 2025).

User satisfaction, for its part, is a key indicator of healthcare performance and a direct reflection of perceived quality. From a comparative perspective, satisfaction arises from the discrepancy between expectations and actual experience, in line with confirmation–disconfirmation theory (Ramasamy et al., 2024), Núñez & Abrego (2022) argue that when the perceived quality of service meets or exceeds expectations, it leads to a positive evaluation, whereas a negative gap results in dissatisfaction; furthermore, Moreno et al. (2025) emphasize that satisfaction represents a subjective impression that encompasses both cognitive and emotional aspects of the healthcare experience; this subjective nature explains the variability in service ratings among different users.

From an attitudinal perspective, satisfaction is interpreted as a lasting disposition that the patient develops toward the healthcare institution (Ramasamy et al., 2024). This attitude is reinforced when care is compassionate, respectful, and person-centered (Carrión & Matts, 2022), various studies have shown that high levels of satisfaction are associated with greater treatment adherence, customer loyalty, and positive recommendations for the service (Bidmon et al., 2020), furthermore, patient satisfaction has a direct impact on the institution's reputation and on the community's trust in the healthcare system (Wang et al., 2024), therefore, measuring satisfaction not only allows us to assess the individual experience, but also to anticipate future user behavior.

Internationally, recent research has confirmed the existence of significant associations between service quality and user satisfaction. Parra & Viñán (2025) found that responsiveness and empathy have the greatest influence on overall satisfaction in hospital settings; similarly, studies conducted in Latin America show that a positive perception of tangible and safety-related factors significantly increases the rating of the service (Zehra et al., 2025), the findings reinforce the idea that perceived quality is a consistent predictor of patient satisfaction.

In the Peruvian context, numerous studies have examined this relationship at various levels of care, Gonzales (2025) reported a moderate positive correlation between quality and satisfaction in dental services. Murayari & Concha (2025) found a significant but weak association in the hospital laboratory department, Garay (2025)

confirmed a statistically significant association in the outpatient setting, whereas Rosales (2025) it was found that higher levels of perceived quality are directly linked to greater satisfaction; the results suggest that service quality consistently influences the user experience, albeit to varying degrees.

Other national studies have shown even stronger correlations. Gutierrez (2024) identified a strong correlation between the two variables at a local health center, while

Ocaña (2025) found a direct and highly significant association in a public setting, Barreda (2022) and Guevara (2022) also confirmed positive correlations within the regional public health system; the evidence reinforces the empirical consensus that service quality is a key determinant of patient satisfaction in the Peruvian healthcare system.

In the Moquegua region, local studies confirm this trend. Manchego & Mamani (2024) reported a high and significant rate at Moquegua Regional Hospital. Solis (2022) showed a moderate impact on users enrolled in the Comprehensive Health Insurance program, while Peña (2025) identified consistent links between quality of care and satisfaction in surgical settings; the literature suggests that, at the regional level, perceptions of quality have a direct impact on the patient experience.

However, despite the abundance of hospital-based evidence, there is a research gap in occupational healthcare settings associated with highly complex mining operations; medical units in industrial settings have unique characteristics, such as immediate response to workplace emergencies, occupational risk management, and high operational demands. In these scenarios, the perception of quality affects not only satisfaction but also workers' trust in the healthcare institution and the company (Souvatzi et al., 2024), the lack of specific studies on this type of unit limits our comprehensive understanding of the phenomenon.

At the Medical Unit of the International Clinic located at the Quellaveco mine in Moquegua, healthcare plays a strategic role in protecting occupational health; however, as in other contexts, gaps may arise in areas such as responsiveness, reliability, or tangible aspects, which influence user satisfaction; identifying these gaps allows for the design of continuous improvement strategies aimed at strengthening the quality of care and the worker's experience.

In light of the above, there is a clear need to specifically analyze the relationship between service quality and user satisfaction in the context of occupational healthcare in the mining industry, where technical requirements, operational efficiency, and high safety standards converge. Within this framework, the overall objective of this study is to determine the relationship between service quality and user satisfaction at the Medical Unit of the International Clinic at the Quellaveco mine in Moquegua during the year 2025.

II. Methodology

Field or place of study

The study was conducted at the Salveani Corporate Medical Unit of the International Clinic, located at the Quellaveco mining project in Moquegua, one of Peru's major copper deposits operated by Anglo American in partnership with Mitsubishi. The camp is situated between 3,500 and 4,500 meters above sea level, in challenging geographical conditions. In this context, the medical unit provides outpatient care, emergency services, and occupational health care, which allowed for an analysis of the relationship between perceived service quality and user satisfaction in an occupational medicine setting.

Figure 8

Geographic location of the Quellaveco mining project, Moquegua, Peru.



Note. Adapted from Google Maps.

Description of Methods

a) Duration of study

The research was conducted in 2025, during which the instruments were validated through expert judgment, the questionnaires were administered, and the data were statistically analyzed (Hernández et al., 2010). The study population consisted of 1,200 monthly visits by employees of Anglo American and contractor companies.

A sample of 291 users was selected using simple random sampling, ensuring representativeness of the population and reducing potential selection bias (Hernández et al., 2010). Participants were included on a voluntary basis after providing informed consent.

The sample size was determined based on statistical criteria for finite populations, and the calculation was verified using spreadsheet tools to ensure accuracy and methodological rigor (Hernández et al., 2010).

b) Detailed description of the materials

Data collection was conducted using a survey method, in which structured questionnaires were administered in person to the workers (Hernández et al., 2010), service quality was assessed using the 22-item SERVPERF scale across five dimensions, with five-point Likert-type responses, while user satisfaction was measured using the 12-item SUCE questionnaire covering clinical and administrative dimensions; both instruments were validated by expert judgment and demonstrated high reliability with Cronbach's alpha coefficients of 0.961 and 0.973, respectively; data analysis was performed using IBM SPSS Statistics version 29.

During the study, technological resources and logistical materials were used to ensure proper information management. In addition, a laptop was used for data entry and database consolidation, as well as printers for reproducing the instruments; furthermore, statistical analysis was performed using IBM SPSS Statistics 29 and Microsoft 365 tools, reference management was carried out with EndNote, and literature review was conducted using academic databases. Finally, the information was stored on external devices and digital platforms, ensuring data confidentiality. (Hernández et al., 2010).

c) Variables analyzed

This study examined two central constructs, defined based on the overall objective and analyzed using a quantitative correlational design. The aim was to determine the association between the perception of service quality and the level of satisfaction among employees treated at the Salveani Corporate Medical Unit of the International Clinic, located at the Quellaveco mining project in Moquegua – 2025 (Hernández et al., 2010).

Variable 1: Quality of service

This construct was operationalized through five components: reliability, responsiveness, assurance, empathy, and tangibles. Data were collected by administering the SERVPERF instrument to 291 employees, who evaluated the performance of medical services in terms of consistency of care, promptness of response, professional competence, individualized care, and the physical conditions of the healthcare environment. The results were organized into perception levels and subsequently coded for statistical (Hernández et al., 2010).

Variable 2: User satisfaction

This variable was structured into two dimensions: clinical satisfaction and administrative satisfaction. The clinical dimension included aspects related to direct medical care, clarity of the information provided, professional treatment, and the trust established during the consultation. On the other hand, the administrative dimension considered elements related to organizational processes, wait times, appointment scheduling, and the service provided by non-clinical staff. Furthermore, participants' responses were classified into satisfaction levels and analyzed using inferential statistical techniques to establish their relationship with perceived service quality (Hernández et al., 2010).

d) Applied statistical testing

Spearman's Rho correlation coefficient was used for the inferential analysis, given the ordinal nature of the variables and the lack of normality, which made it possible to determine the strength and direction of the association between perceived service quality and user satisfaction (Hernández et al., 2010), in addition, a significance level of 0.05 was set for decision-making, with a relationship considered statistically significant when $p < 0.05$, data processing and analysis were performed using IBM SPSS Statistics version 29.

III. Results and Discussion

3.1. Results

Table 1 shows that the largest concentration of users falls into the “agree” category regarding service quality and the “satisfied” category regarding user satisfaction, accounting for 36.0%, which indicates that a favorable perception of the service is predominantly linked to positive levels of satisfaction. Overall, 59.2% of respondents reported being satisfied and 12.3% very satisfied, reflecting a majority trend toward positive ratings. In contrast, combinations that integrate extremely positive perceptions with dissatisfaction represent minimal percentages, such as 0.3%, indicating that inconsistent ratings between perceived quality and satisfaction are rare in the evaluated medical unit.

Table 2

The Relationship Between Service Quality and Customer Satisfaction

		User satisfaction											
		Very dissatisfied		Dissatisfied		Indifferent		Satisfied		Very satisfied		Total	
		fi	%	fi	%	fi	%	fi	%	fi	%	fi	%
Quality of service	Strongly disagree	4	1.4	0	0.0	3	1.0	10	3.4	3	1.0	20	6.8
	Disagree	7	2.4	3	1.0	5	1.7	27	9.2	8	2.7	50	17.1
	Undecided	4	1.4	2	0.7	7	2.4	26	8.9	6	2.1	45	15.4
	Agree	18	6.2	9	3.1	16	5.5	105	36.0	17	5.8	165	56.5
	Strongly agree	1	0.3	1	0.3	2	0.7	5	1.7	2	0.7	11	3.8
	Total	34	11.6	15	5.1	33	11.3	173	59.2	36	12.3	291	100.0

Figure 9

The Relationship Between Service Quality and Customer Satisfaction

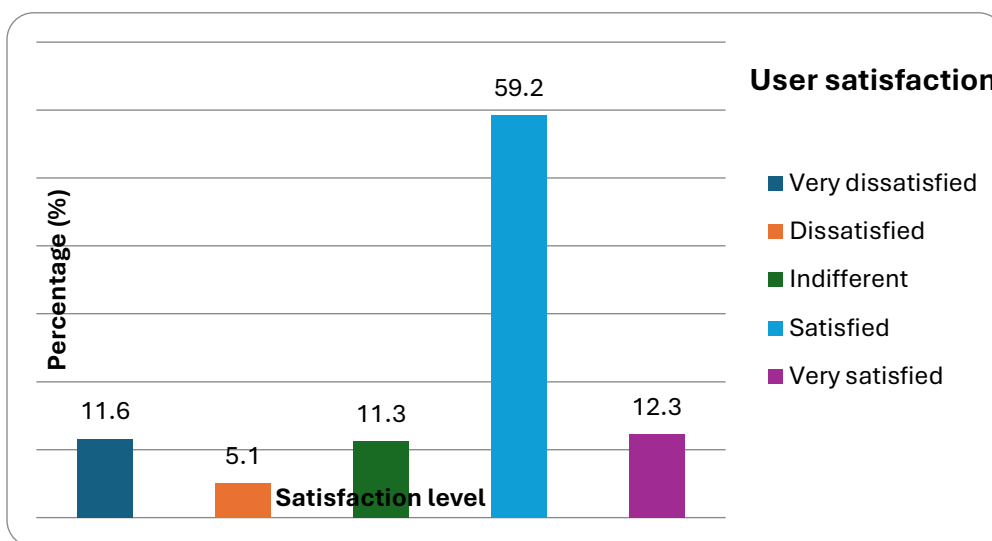


Table 2 and Figure 2 show a moderate positive correlation between service quality and user satisfaction, with a Spearman's Rho coefficient of 0.407 and a two-tailed p-value of 0.005, which is below the critical level of 0.05; This result confirms the existence of a statistically significant association between the two variables, indicating that as the perception of service quality improves, the level of satisfaction among patients treated at the medical facility tends to increase. Consequently, the null hypothesis is rejected

and the alternative hypothesis is validated, demonstrating that service quality constitutes a relevant factor in the user experience within the evaluated context.

Table 3

The degree of correlation between service quality and user satisfaction

		Quality of service	User satisfaction
Rho de Spearman	Correlation coefficient	1.000	0.407
	Quality of service Sig. (two-tailed)		0.005
	N	291	291
	Correlation coefficient	0.407	1.000
	User satisfaction Sig. (two-tailed)	0.005	
	N	291	291

Table 10 shows that the chi-square statistic is 287.952 with 4 degrees of freedom and an asymptotic significance level of 0.000, a result that is below the 0.05 threshold; This finding indicates that the distribution of user satisfaction is not uniform; rather, there are statistically significant differences across the evaluated categories. Consequently, it is evident that the level of satisfaction among patients treated at the medical facility shows a clear trend, reflecting a differentiated assessment of the service received.

Table 4

Level of satisfaction among patients treated at the medical facility

	User satisfaction
Chi-square	287,952 ^a
df	4
Asymp. Sig.	0.000

Table 4 shows a weak positive correlation between the reliability dimension and user satisfaction, with a Spearman's Rho coefficient of 0.337 and a two-tailed significance level of 0.030, which is less than 0.05, the result demonstrates that there is a statistically significant relationship between the two variables, indicating that when users perceive greater compliance and consistency in service delivery, they tend to express higher levels of satisfaction; consequently, the reliability of medical services emerges as a relevant component in the overall assessment of the user experience.

Table 5

The degree of correlation between reliability and user satisfaction

		Reliability	User satisfaction
Rho de Spearman	Reliability	Correlation coefficient	1.000
		Sig. (two-tailed)	0.030
		N	291
	User satisfaction	Correlation coefficient	0.337
		Sig. (two-tailed)	0.030
		N	291

Table 5 shows a moderate positive correlation between the responsiveness dimension and user satisfaction, with a Spearman's Rho coefficient of 0.430 and a two-tailed significance level of 0.013, which is less than 0.05; this result confirms the existence of a statistically significant relationship between the two variables, demonstrating that a greater perception of promptness, willingness, and agility in care is associated with higher levels of satisfaction among the workers receiving care; consequently, the responsiveness of the medical service is established as a determining factor in the positive evaluation of the care experience.

Table 6

Degree of correlation between responsiveness and user satisfaction

		Responsiveness	User satisfaction
Rho de Spearman	Responsiveness	Correlation coefficient	1.000
		Sig. (two-tailed)	0.013
		N	291
	User satisfaction	Correlation coefficient	0.430
		Sig. (two-tailed)	0.013
		N	291

Table 6 shows a moderate positive correlation between the safety dimension and user satisfaction, with a Spearman's Rho coefficient of 0.392 and a two-tailed significance level of 0.017, which is lower than the critical value of 0.05; This result indicates that there is a statistically significant association between the two variables, suggesting that when users perceive professional competence, trust, and proper handling of procedures, they tend to express higher levels of satisfaction; consequently, perceived safety in medical care represents an influential component in the overall evaluation of the service provided.

Table 7

The extent of the relationship between security and user satisfaction

		Security	User satisfaction
Rho de Spearman	Security	Correlation coefficient	1.000
		Sig. (two-tailed)	0.017
		N	291
	User satisfaction	Correlation coefficient	0.392
		Sig. (two-tailed)	0.017
		N	291

Table 7 shows a low-to-moderate positive correlation between the empathy dimension and user satisfaction, with a Spearman's Rho coefficient of 0.354 and a two-tailed significance level of 0.002 a value considerably lower than 0.05 the result demonstrates a statistically significant association, indicating that when users perceive cordial, personalized, and understanding treatment from healthcare staff, they tend to report higher levels of satisfaction; consequently, empathy in medical care constitutes a relevant element in creating a favorable experience for the patients being treated.

Table 8

The relationship between empathy and user satisfaction

		Empathy	User satisfaction
Rho de Spearman	Empathy	Correlation coefficient	1.000
		Sig. (two-tailed)	0.002
		N	291
	User satisfaction	Correlation coefficient	0.354
		Sig. (two-tailed)	0.002
		N	291

Table 8 shows a moderate positive correlation between the tangible aspects dimension and user satisfaction, with a Spearman's Rho coefficient of 0.429 and a two-tailed significance level of 0.004, which is less than 0.05, This result confirms the existence of a statistically significant relationship, indicating that better physical conditions, adequate infrastructure, visible equipment, and staff appearance are associated with higher levels of satisfaction among the patients served; consequently, the tangible elements of the service have a significant influence on the overall perception and evaluation of the care experience.

Table 9

Degree of correlation between tangible aspects and user satisfaction

		Tangible aspects	User satisfaction
Rho de Spearman	Correlation coefficient	1.000	0.429
	Tangible aspects Sig. (two-tailed)		0.004
	N	291	291
	Correlation coefficient	0.429	1.000
	User satisfaction Sig. (two-tailed)	0.004	
	N	291	291

3.2. Discussion

A positive and statistically significant association was identified between service quality and user satisfaction at the Salveani Corporate Medical Unit. This moderate correlation confirms that a favorable perception of healthcare performance is associated with higher levels of satisfaction among the employees receiving care; the result is consistent with the findings reported by Ramasamy et al. (2024), argue that satisfaction arises when the actual experience meets or exceeds the user's expectations; this also supports the approach of Moreno et al. (2025), who emphasize that satisfaction encompasses both cognitive and emotional aspects stemming from the care process.

In line with international evidence, the results are consistent with those reported by Parra & Viñán (2025), who identified significant associations between quality and satisfaction in hospital settings; similarly, Zehra et al. (2025) noted that the tangible and safety dimensions directly influence the overall evaluation of the service; in this study, tangible aspects and responsiveness showed the strongest associations with user satisfaction, suggesting that, in highly demanding operational contexts such as the mining industry, adequate infrastructure and prompt service are strategically important for users.

The performance of the responsiveness dimension is particularly significant, as its moderate association with satisfaction confirms the findings reported by Hui et al. (2024), who emphasize that the staff's responsiveness and willingness to help reduce patient anxiety and strengthen their perception of the institution's efficiency; in an environment like Quellaveco, where work activities involve occupational risks and extreme geographical conditions, timely care is a key factor in building trust in the medical service.

The safety dimension was significantly associated with user satisfaction, consistent with the findings reported by Qing et al. (2023), argue that technical competence and professional assurance significantly influence the patient experience note that this finding takes on particular importance in occupational medicine, where the perception

of clinical support affects not only immediate satisfaction but also sustained trust in the healthcare institution and the employer, as suggested by Souvatzi et al. (2024).

With regard to reliability and empathy, although the associations were weaker, they remained statistically significant; the findings are consistent with the theoretical framework of the SERVQUAL model described by Endeshaw (2020), which suggests that consistent service delivery and personalized care contribute to the user's overall evaluation; however, in the mining context under study, these components appear to carry slightly less weight than operational factors, a finding that could be explained by the priority workers place on the efficiency and effectiveness of medical services.

Nationally, the results are consistent with those reported by Gonzales (2025) who identified moderate correlations between quality and satisfaction in outpatient services; furthermore, they agree with Murayari & Concha (2025), who found significant associations, albeit of lesser magnitude, in the hospital setting; however, the magnitude observed in the present study is lower than that reported by Ocaña (2025), who identified high levels of satisfaction at public health centers, which could be attributed to contextual differences in service organization and user expectations.

At the regional level, the findings are consistent with those reported by Manchego & Mamani (2024) at the Moquegua Regional Hospital, who reported a significant association between quality and satisfaction; however, the present study offers a unique perspective by being conducted in a mining occupational health clinic a setting that has been scarcely explored in the scientific literature. This distinctive feature reinforces the study's relevance, given that industrial health clinics operate under different care dynamics than conventional hospitals.

IV. Conclusions

With regard to the overall objective, it is concluded that there is a positive, statistically significant correlation between service quality and user satisfaction at the Medical Unit of the International Clinic at the Quellaveco mine in Moquegua 2025. Spearman's Rho coefficient indicated a moderate correlation, suggesting that the more favorable the perception of service quality, the higher the level of satisfaction among treated workers; consequently, it is confirmed that service quality constitutes a determining factor in the healthcare experience within the mining occupational context.

Regarding the level of satisfaction among users served at the medical unit, it falls predominantly into positive categories, with the group of users who report being satisfied standing out. This indicates that most workers perceive the care received favorably, reflecting healthcare performance in line with their expectations.

The findings indicate that all dimensions of service quality exhibit positive and statistically significant relationships with user satisfaction, albeit with varying magnitudes. Responsiveness and tangibles emerge as the most influential factors,

underscoring the importance of prompt care, operational efficiency, and adequate physical conditions in shaping user perceptions within high-demand occupational settings. Safety also plays a critical role by reinforcing trust through professional competence and assurance, while empathy contributes to satisfaction by fostering humanized and personalized care. Although reliability presents a comparatively lower correlation, it remains essential for ensuring consistency, accuracy, and credibility in service delivery. Collectively, these results highlight that user satisfaction is a multidimensional construct influenced by both operational and interpersonal factors, emphasizing the need for an integrated approach to improving healthcare quality in occupational contexts.

Statement of Ethics

The research was conducted in accordance with fundamental ethical principles, ensuring voluntary participation through informed consent, as well as the confidentiality and anonymity of the participants. Furthermore, the study was conducted in accordance with principles of transparency, accountability, and respect for the rights of all those involved.

Acknowledgments

I would like to thank the Medical Unit at the International Clinic at the Quellaveco mine for their assistance in conducting this study.

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Tax Administration and Its Impact on the Collection of Revenues in the Municipal Government of Puno

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ABSTRACT

In the Municipal Government of Puno, the management of tax administration and its influence on the efficiency of revenue collection is a significant challenge. Despite efforts to improve collection processes and systems, problems related to administrative inefficiency, tax evasion and lack of technological modernization persist. These factors contribute to low tax collection, which limits the government's ability to finance essential projects and public services, directly affecting the development and welfare of the local community. The objective of the research is to determine the influence on revenue collection in the Tax Administration Department. Regarding the methodology, it corresponds to the non-experimental correlational type, the design is descriptive method. The population is constituted by 3250 taxpayers, the sample was formed by 293 taxpayers through probabilistic sampling. In relation to the techniques, a survey was used, consisting of a questionnaire with 15 questions, and the documentary analysis technique was used. The results obtained show that the influence of the tax administration on revenue collection is 81.54 %, so it can be explained that the level of influence of the tax administration is considerable, and the remaining percentage (18.46%) explains the influence of other factors. It is concluded that, the Tax Administration significantly influences revenue collection in the municipal government of Puno, with a coefficient of 0.903 which indicates that the correlation is very strong positive.

Keywords: Administration, coercive collection, collection, municipal, tax revenues, taxes.

I. Introduction

The process of planning, organizing, and controlling municipal taxes is composed of: auditing, coercive collection, and revenue collection, managed by the revenue

management of local governments, which is the body that, in addition to administering taxes, also proposes policies to simplify the tax system and which is central to the compliance of the municipal tax system municipal (Bravo 2012). Local entities are the only ones that can set and reform rates and contributions as long as the limits stipulated by legislative authorities are respected, but they can never circumvent the tax. The effectiveness of tax administration turns out to be the capacity it exercises when applying tax regulations (Ministry of Economy and Finance 2017).

It is urgent to take measures to educate citizens about their tax responsibilities. A more effective commitment to these civic obligations will support national development, financing critical infrastructures such as schools and hospitals (Cárdenas 2020). Municipalities act as representatives of the local community, promoting the correct provision of public services locally, the well-being of residents, and the comprehensive and harmonious development of their jurisdictions (López 2008).

Reforming tax administration within a municipality can be complex due to established interests. An interesting solution is the deactivation of the existing administrative structure and its replacement by a more modern and efficient organization, as suggested by Chilingano and Morales (2018). This approach has been successful in the Provincial Municipality of Lima, which since 1996 has operated with the Tax Administration Service (SAT).

However, there are critics like Bonilla (2014) who argue that private sector management principles are not always applicable to public entities, questioning the suitability of these practices in a governmental context. It is important that these plans are built upon effective instruments and procedures, but also that they are fully harmonized and adapted to what the regulations establish, thereby ensuring at all times that the auditing action respects rights and obligations in accordance with legal regulations. In this way, legitimacy and justice are reinforced in the tax supervision process (Soto 2015).

The problem is that most municipal governments have not given it the importance it truly has, either because they are unaware of its effectiveness, because they cling to continuing to administer in the old way, that is, through empirical administration, or due to the lack of legal obligation to use it (Chávez 2024). Administrative systems play a crucial role in guiding and organizing the activities of public entities and their managers, facilitating the achievement of pre-established objectives and goals through effective coordination of activities and optimal utilization of resources. These systems are designed to ensure that public management is efficient, effective, and inclusive, resulting in tangible benefits for citizens, as noted by the International Institute for Democracy and Electoral Assistance - IDEA International (2009).

The coercive collection process is articulated from the communication of the resolution of the coercive enforcement procedure to the debtor. The act of resolution is, in this

sense, relevant because it implies an explicit order of mandatory compliance, and furthermore, it warns of the possible execution of precautionary measures and possible forced execution to guarantee the recovery of outstanding taxes (Armas and Colmenares 2009). The function of tax collection must take into account the precise management of information that taxpayers can provide, as well as the due dates foreseen for each of them. It is necessary to verify that the appropriate documents are used for the payment of taxes, as well as for the submission of settlements, thus enabling legality and accuracy during collection (Soria et al. 2022).

Therefore, cooperation and support from the national government and the National Superintendence of Customs and Tax Administration (SUNAT) must be strengthened for the modernization of municipal governments. This new proposal and way of working promotes cooperation but, in addition, cross-control is established, which is fundamental for increasing the efficiency of SUNAT in the collection and auditing of tax administrations, but also of municipal tax administrations (Inter-American Center of Tax Administrations - CIAT 2019). Bonilla (2014) argues that citizens who voluntarily contribute with the payment of their taxes do so both out of personal responsibility and for the nation, without taking local ordinances into account, and that punctuality in tax payment is not only an indicator of timely compliance, but also implies a form of rejection of the deviation from practices focused on fulfilling the objective of filling municipal coffers.

For his part, Flores (2004) argues that the duality of tax laws, both flexible and strict, is necessary to facilitate the State's achievement of public objectives, such as construction and others, which at the same time allows public spending to meet that objective. Furthermore,

Chavez (2014) emphasizes that tax payment should not be seen merely as a legal obligation, but as a moral duty, highlighting the importance of civic ethics beyond simple compliance with the law. According to the Government of Peru (2020), municipalities' own revenues include taxes established by law, as well as contributions, fees, charges, licenses, fines, and rights created by their municipal councils. In addition, they have resources assigned from the municipal compensation fund.

On the other hand, SUNAT (2020) establishes that infractions committed by citizens are objectively determined and can be sanctioned in various ways, including the temporary or permanent impoundment of vehicles, temporary or permanent closure of establishments or commercial premises, and the suspension of licenses, among other penalties. Ramos and Zambora (2020) define collection as the set of activities carried out by the administration to ensure the entry of tax revenues into the municipal treasury. In the current context, characterized by increasing digitalization and a reduced need for in-person interactions for daily activities, the opportunity arises to implement innovative methods that facilitate citizens' compliance with their tax obligations. Among collection strategies, one can mention strategies to improve access to more

service points in the municipality from which taxpayers can pay their taxes, as well as offering early payment discounts or incentives for compliance. For example, according to Bravo (2015), these early payment discounts constitute a very effective collection strategy to motivate citizens to feel more committed to the timely payment of their taxes. El Peruano (2013) highlights the importance of taxes as important fiscal instruments, but when detailing property tax, its reflection reveals what happens with a solid tax base, almost impossible to ignore.

Ramírez (2019) indicates that taxes, in addition to being revenue-generating, can also be used for urban development and planning, especially in developing countries where fiscal decentralization is beginning to gain greater importance. Serrano (2012) and Camargo (2013) are pleased to discuss tax evasion, as they argue that such activity (evasion) "means the illegal reduction of the tax burden, but, to further complicate the matter, it affects the capacity of municipalities to cope with their basic tasks and needs basic" and Camargo adds that these evasion practices include avoidance and are constituted by maneuvers such as underreporting income or overestimating deductible expenses, which thus poses a significant difficulty for tax administration.

Cornejo (2017) makes it clear that it is important to tackle evasion in order to improve tax collection, which would allow for an increase in social spending and, therefore, improve the quality of life for citizens. Chilingano and Morales (2018) insist on the need for an efficient and well-organized tax administration capable of ensuring compliance with tax obligations and maximizing collection. For the tax system, proper management of taxes and the respective strategic process are necessary (Zegarra 2015)

Osterling and Castillo (2001) mention the legal framework that establishes rights and duties for the State and taxpayers, according to which such a legal relationship is created, requiring that, in accordance with the established legal regime, tax obligations are fulfilled in a manner that protects the interests of the State and guarantees resources for it (Robles, 2008).

Finally, Cárdenas (2020) mentions the taxpayer's responsibility to pay taxes because it is an act not only of fulfilling a legal obligation but also a very important contribution to the execution of public works and government attention. The specific objectives proposed were the following: to identify the levels of functions of the tax administration, and the other objective is to identify revenue collection in the Municipal Government of Puno.

II. Methodology

The present investigation was carried out in the Provincial Municipality of Puno, located in the region of Puno, Peru. This region is part of the Andean altiplano and is located in the southeastern part of the country, in west-central South America. The territory of the Puno region covers an approximate area of 1,285,216.60 km², making it one of the most extensive regions of the country in geographical terms. This

geostrategic location influences various administrative, social, and economic aspects, which are relevant to the study developed.

The population included 3,250 taxpayers from the municipal government of Puno, with a sample of 294 compliant taxpayers. The study is quantitative, non-experimental, and correlational in design. A 15-item Yes/No survey was used to measure tax administration efficiency, and documentary analysis of official records was applied to assess municipal revenue collection, enabling analysis of their relationship. Tax administration efficiency: management and control of tax processes to ensure compliance with efficiency, equity, and transparency. Municipal revenue collection: generation of income from taxes and other legal sources to fund public services and projects. The Chi-square non-parametric test was used for hypothesis testing with SPSS version 25.

III. Results and discussion

3.1. Results

Identify the Levels of functions of tax administration in the Municipal Government of Puno According to the data presented in Table 1, it is observed that the predominant level of functions of the tax administration in the Municipal Government of Puno has been rated as "Good" by 47.3% of respondents, which is equivalent to 139 people. This result indicates that, for almost half of the participants, tax management shows positive characteristics in terms of organization, compliance, and efficiency in its functions. This favorable perception could be associated with improvements in administrative processes, technology implementation, or increased training of personnel involved in collection and auditing.

On the other hand, 27.6% of respondents (81 people) consider the unctions of the tax administration to be "Deficient". This data reveals a significant concern, as more than a quarter of the population perceives shortcomings in tax management, which could be related to deficiencies in oversight, outdated registers, low coverage of taxpayers or lack of effective control and monitoring mechanisms.

Finally, 25.2% (74 respondents) opined that tax administration is "Regular", which suggests that, while some aspects might be functioning acceptably, there is still considerable room for improvement. This category represents a significant portion of the participants who perceive an intermediate performance, possibly conditioned by disparate experiences with the service.

While the majority result is positive, more than half of respondents consider the service to be regular or deficient, which highlights the need to implement strategies for institutional strengthening to improve the efficiency, transparency, and coverage of tax administration in the Provincial Municipality of Puno.

Table 1

Identify the levels of tax administration functions in the Municipal Government of Puno

Levels of functions of the tax administration	Frequency	Percentage
Deficient	81	27.6
Regular	74	25.2
Good	139	47.3
TOTALS	294	100.0

Note: data obtained from the Provincial Municipality of Puno

Revenue collection in the Municipal Government of Puno

According to the results presented in Table 2, it can be observed that the majority of respondents, equivalent to 52.7% (155 people), consider that revenue collection in the Municipal Government of Puno is carried out belatedly. This data reveals a significant problem regarding the timeliness of tax collection, which can have negative repercussions on financial planning, budget execution, and public service provision. The delay in collection may be due to factors such as lack of taxpayer incentives, weaknesses in administrative management, inadequate dissemination of payment schedules, or a weak tax culture.

On the other hand, 47.3% of respondents (139 people) perceive that collection is carried out in a timely manner, which reflects that, although there is a considerable portion of citizens who comply with their obligations within the established deadlines, an optimal level of collection efficiency has not yet been reached.

This group represents a potential on which strategies for strengthening and fostering tax compliance could be focused, through policies such as early payment discounts, information campaigns, or more accessible payment channels.

The data shows a divided panorama, with a slight majority indicating temporary inefficiency in the collection process. This highlights the urgent need to optimize collection mechanisms, update tax management systems, and promote a civic culture of fiscal responsibility, in order to improve the financial sustainability of the local government.

Table 2

Identify revenue collection in the Municipal Government of Puno

Revenue Collection	Frequency	Percentage
Late	155	52.7
Timely	139	47.3
TOTALS	294	100.0

Note: Data obtained from the Provincial Municipality of Puno

3.2. Discussion

This result aligns with various national and international studies. Macalopu (2023), in his research in Bagua, showed that tax management based on planning, adequate control, and oversight generated a 20.52% increase in property tax collection in just one year. Similarly, Espinoza (2021) in Moyobamba reported a correlation coefficient of 0.895 between administrative management and tax collection, which demonstrates a direct and positive relationship. Along the same lines, Ramos and Zambora (2020) showed that good administration not only facilitates collection but also strengthens the trust of citizens in the municipal institution.

In the local context, these results are also in harmony with Zuñiga's (2021) research, who indicated that taxpayer satisfaction levels largely depend on the effectiveness of service, clarity in payment processes, and the organization of the tax area. Thus, a well-structured tax administration not only increases collection but also promotes a better relationship with citizens, which is key for the fiscal and social sustainability of the municipality.

Together, the findings of this research not only ratify the hypothesis, but also provide solid empirical evidence to support the importance of improving tax administration as a key strategy to optimize revenue collection. Institutional strengthening, staff training, the use of technological tools, and a citizen-centric approach are central elements that must be integrated into municipal development plans.

This result is consistent with previous research. At the national level, Reyes and Villanueva (2022) concluded that tax collection in the Provincial Municipality of Huancayo is affected by the lack of defined functions and insufficient staff training responsible, which limits institutional performance. Similarly, in the local context, Zuñiga (2021) identified in his research conducted in the Municipality of Puno that a significant part of taxpayers expressed dissatisfaction regarding service processes, data management, and communication from the revenue department, which reinforces the need to strengthen the organizational structure and human resources in the municipality.

Furthermore, considering that almost three out of ten respondents rate tax management as "deficient," the importance of implementing corrective strategies is highlighted. Among these, it is suggested to invest in the digitalization of administrative processes, continuously train staff on fiscal matters, and establish management indicators to evaluate performance and make informed decisions.

This problem has also been identified in other studies. For example, Valencia (2022) found that in the District Municipality of Maranura, tax management was not always systematically developed, which resulted in delays in fiscal revenue. Likewise, Chonillo and Salazar (2023), from an international perspective, highlighted that one of the main factors contributing to low collection is the weak tax culture of citizens, coupled with a scarce implementation of modern collection strategies. This aligns with the situation evidenced in Puno, where agile and motivating mechanisms for timely payment, such as the installation of digital platforms, decentralized payment points, or tax incentive programs, have not yet been consolidated.

The divided perception between "timely collection" and "late collection" also suggests that there is a group of taxpayers who do comply with their obligations within the established deadlines, which represents an opportunity for the municipality: if adequate policies of tax education, awareness campaigns, and technological improvements are implemented, this percentage could increase, promoting a stronger tax culture and a more predictable and efficient financial flow.

IV. Conclusions

It is concluded that the functions of the tax administration in the Municipal Government of Puno are mostly perceived as good, although a considerable percentage of citizens still consider them regular or deficient, which highlights the need to strengthen operational efficiency, internal organization, and the quality of tax service.

Most respondents perceive that revenue collection in the municipality is carried out late, which reveals weaknesses in collection management and in the tax culture of the population, aspects that must be addressed to improve the timeliness and effectiveness in income generation.

It is concluded that there is a significant influence of tax administration on revenue collection of the Municipal Government of Puno, which confirms that the strengthening of tax management is key to improving income levels and municipal financial sustainability.

Ethics statement

The research was developed respecting principles of academic integrity, confidentiality, and responsible use of information. The data were used solely for academic and analysis purposes, preserving respect for participants and avoiding any manipulation of results.

Acknowledgement

To the Graduate School of the National University of Altiplano Puno for having trained me professionally.

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